PACIFIC SALMON COMMISSION
JOINT CHINOOK TECHNICAL COMMITTEE

ANNUAL REPORT OF CATCH AND ESCAPEMENT FOR 2005

REPORT TCCHINOOK (06)-2

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List of Acronyms and Abbreviations

AABM	Aggregate Abundance Based Management
ADF&G	Alaska Department of Fish and Game
Agreement	June 30, 1999 PST Annex and the Related Agreement
AUC	Area-Under-the-Curve
BC	British Columbia
CBC	Central British Columbia (Kitimat to Cape Caution)
CI	Confidence Interval
CNR	Chinook Nonretention
CR	Chinook Retention
CPUE	Catch per unit effort
CRITFC	Columbia River Intertribal Fish Commission
CTC	Chinook Technical Committee
CV	Coefficient of Variation
CWT	Coded Wire Tag
CY	Calendar Year
DFO	Canadian Department of Fisheries and Oceans
ESA	US Endangered Species Act
FNC	First Nations Caucus
FR	Fraser River
FSC	Food, Social, and Ceremonial
GMR	Genetic Mark–Recapture
GW	Gitwinksihlkw
IM	Incidental Mortality
ISBM	Individual Stock Based Management
JDF	Juan De Fuca
LAT	Low Abundance Threshold
LC	Landed Catch
LGS	Lower Strait of Georgia
LIM	Legal Incidental Mortality
MOC	Mid-Oregon Coast
MR	Mark–Recapture
MRE	Mature-Run Equivalent
MSY	Maximum Sustainable Yield for a stock, in adult equivalents
NA	Not Available
NC	North Coastal
NBC	Northern British Columbia (Dixon Entrance to Kitimat including Queen Charlotte Islands)
NMFS	National Marine Fisheries Service
NOC	North Oregon Coast
NWIFC	Northwest Indian Fisheries Commission
ODFW	Oregon Department of Fish and Wildlife
ORC	Oregon Coast
PS	Puget Sound
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
QIN	Quinault Nation
QCI	Haida Gwaii (Queen Charlotte Islands)
SIM	Sublegal Incidental Mortality
SMSY	Escapement producing MSY
SEAK	Southeast Alaska Cape Suckling to Dixon Entrance
SSP	Sentinel Stocks Program
SUS	Southern US
TBR	Transboundary Rivers (Alsek, Taku, Stikine)
TM	Total Mortality
UAF	University of Alaska Fairbanks
UGS	Upper Strait of Georgia
UMT	Upper Management Threshold
UMSY	Exploitation Rate at MSY
USFWS	US Fish & Wildlife Service
US	United States
WAC	Washington Coast
WCVI	West Coast Vancouver Island excluding Area 20
WDFW	Washington Department of Fish and Wildlife

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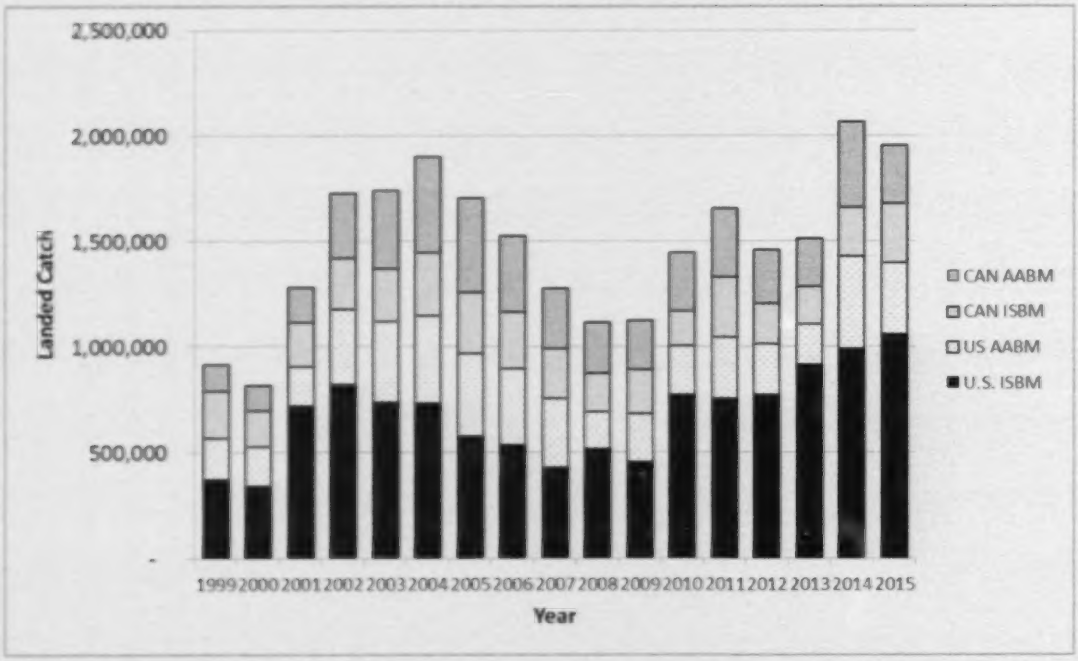
EXECUTIVE SUMMARY

The Pacific Salmon Treaty (PST) requires the Chinook Technical Committee (CTC) to report annual catch and escapement data for Chinook salmon stocks that are managed under the Treaty. The CTC provides an annual report to the Pacific Salmon Commission (PSC) to fulfill this obligation. This report contains three sections: Chinook salmon catches, escapements, and stock status, providing an indication of stock performance in the context of management objectives for 2015.

Section 1 summarizes fishery catches by region and available estimates of incidental mortality (IM) by fishery in 2015, with accompanying commentary on the fisheries, management, and derivation of IM. Annual catch data are compiled by Canada and the US for their respective jurisdictions within the PST area according to fishery regimes, regional locations, and gear type with estimates of IM. Landed catch (LC) is fully reported in the appendices for each geographic area covered under the PST; a summary for all PSC Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries, from 1999 to 2015, is provided in the figure below. Time series of available IM estimates are provided in Appendix A for individual fisheries. Appendix A also includes a coastwide summary of the historical time series of LC, IM, and their sum, total mortality (TM), across all AABM and ISBM fisheries.



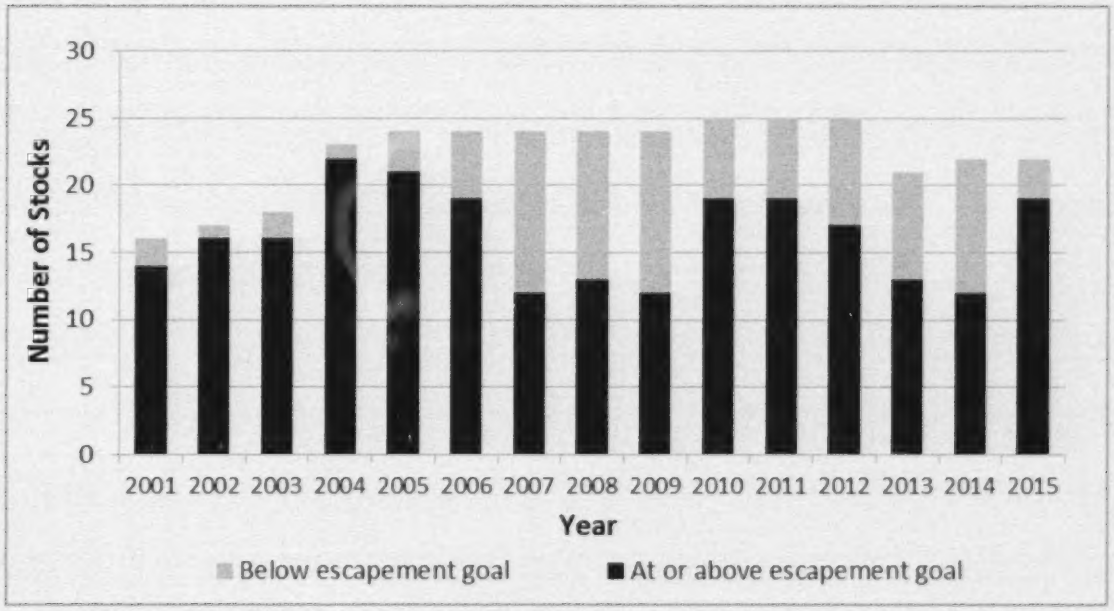
Estimates of landed catch for US and Canada AABM and ISBM fisheries, 1999–2015.

The preliminary estimate of Treaty LC of Chinook salmon for all PST fisheries in 2015 is 1,955,047, of which 1,397,875 were taken in US fisheries and 557,172 were taken in Canadian fisheries. The estimated total IM associated with this harvest is 223,089 nominal Chinook salmon. The TM for all PST fisheries in nominal fish was 2,178,136 Chinook salmon, of which 1,544,669 were taken in US fisheries and 633,468 were taken in Canadian fisheries. For US

fisheries, 76% of the LC and 75% of TM occurred in ISBM fisheries; in Canada, 51% of the LC and 51% of TM occurred in ISBM fisheries. For some component sport fisheries, 2015 LC and IM estimates are not yet available.

Section 2 includes an assessment of escapement for PST escapement indicator stocks/stock aggregates with CTC-accepted biologically based goals (22 stocks) as well as escapement data for the other indicator stocks/stock aggregates (24 stocks). For eight of these, the escapement goal is defined as a range; for the remaining 14, the escapement goal is the point estimate of S_{MSY} (escapement producing maximum sustained yield). Annual escapements that are more than 15% below the lower end of the range or the S_{MSY} point estimate are noted. The CTC will continue to review escapement goals for stocks as they are provided by respective agencies.

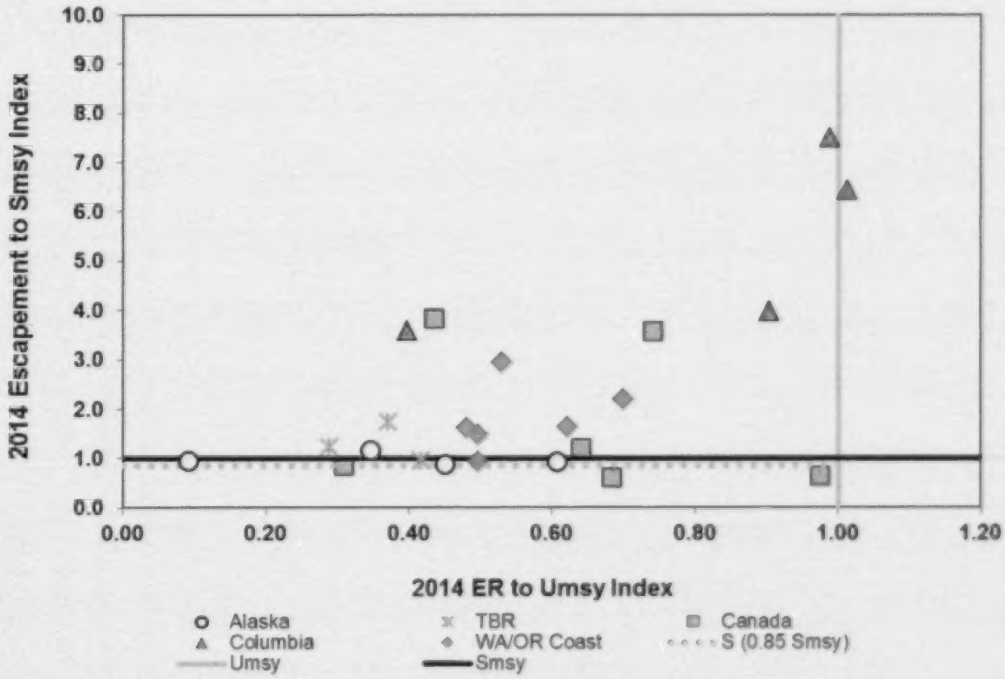
From 1999 to 2015, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 50% to 96% (see figure below). In 2015, 19 of 22 stocks (86%) met or exceeded escapement objectives. Of the three stocks below goal, one stock (Cowichan) was within 15% of the target goal. Two stocks were more than 15% below goal (Situk and Queets spring/summer).



Number and status of stocks with CTC-accepted escapement goals, 1999–2015. The Keta, Blossom, and King Salmon rivers and Andrews Creek stocks were dropped as escapement indicator stocks in 2013 and Grays Harbor fall was added in 2014, bringing the total number of current indicator stocks with CTC-accepted escapement goals to 22 since 2014.

Section 3 presents a synoptic evaluation of stock status that summarizes the performance of those stocks relative to established goals over time for many of the escapement indicator stocks. This evaluation draws upon catch information (Section 1), escapement information (Section 2), and exploitation rates and other information to evaluate the status of stocks.

Synoptic plots present both the current status of stocks and the history of the stocks relative to PST management objectives; this information clearly summarizes the performance of fisheries management relative to stocks achieving established or potential goals. A synoptic summary figure for 23 stocks with 2014 data shows that the majority of stocks were in the safe zone. No stocks were in the high risk zone and two stocks (Cowichan and Harrison) were in the low escapement and low exploitation zone. Two stocks (Columbia Summers and Columbia Upriver Brights) experienced exploitation near U_{MSY} (exploitation rate at maximum sustainable yield for a stock) and still the escapement exceeded S_{MSY} by 6-fold. The Southeast Alaska, Transboundary River, and Washington and Oregon coastal stocks clustered closer to the 1.0 index lines than the other regional groups. In general, Columbia River stocks showed a higher escapement to S_{MSY} index than the other regions where there was no pattern.



Synoptic summary by region of stock status for stocks with escapement and exploitation rate data in 2014 (escapement and exploitation rate data for each stock was standardized to the stock-specific escapement goal and U_{MSY} reference points).

1. Chinook Salmon Catch

The 1999 Pacific Salmon Treaty Annex and the Related Agreement (Agreement) substantially changed the objectives and structure of the PSC Chinook salmon fisheries by eliminating the previous ceiling and pass-through fisheries and replacing them with Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries. The Agreement defines catch limits based on aggregate abundance for Chinook salmon in AABM fisheries, and requires that ISBM fisheries be managed on a national basis to meet stock-specific agreed-to maximum sustainable yield (MSY) or other biologically based escapement objectives (and/or exploitation rates for 4 of the 49 named stocks) or to limit adult equivalent mortality rates for these stocks to a portion of the 1979 to 1982 base period or the average 1991 to 1996 rate. The 2009 Agreement imposed additional reductions to catch limits in West Coast Vancouver Island (WCVI) and Southeast Alaska (SEAK) fisheries.

This report assesses landed catch (LC), incidental mortality (IM) and total fishing mortality (TM) for all Pacific Salmon Treaty (PST) fisheries in 2015, both those targeting Chinook salmon (Chinook Retention; CR) as well as those directed at other salmon species (Chinook Nonretention; CNR). The LC, IM and TM estimates for the three AABM fisheries are presented by gear sector in Table 1.6 and Table 1.7 and similar estimates for Canada and US ISBM fisheries are summarized in Table 1.8 and Table 1.9. A summary of LC, IM, and TM estimates for Chinook salmon in all PST AABM and ISBM fisheries is presented in Table 1.10.

The CTC began reporting IM in AABM fisheries in 2004 (CTC 2004a) and in most ISBM fisheries in 2005 (CTC 2005). The current reporting of LC and IM estimates provides a comprehensive overview of all PST fisheries that harvest Chinook salmon. Commentary is provided to explain fisheries, management, and derivation of estimates of IM. Historical LC, IM, and TM data are given in Appendix A.

1.1 Review of Aggregate Abundance Based Management Fisheries

AABM fisheries for Chinook salmon are managed to an allowable catch associated with an annual abundance index (2009 PST Agreement, Annex IV, Chapter 3, Table 1). AABM fisheries are mixed stock salmon fisheries that intercept and catch migratory Chinook salmon from many stocks. There are three AABM fisheries (2009 PST Agreement, Annex IV, Chapter 3, paragraph 2):

(1) Southeast Alaska (SEAK) All Gear (Troll, Net, Sport)

(2) Northern British Columbia (NBC) Troll and Haida Gwaii (QCI) Sport

(3) West Coast Vancouver Island (WCVI) Troll and Outside Sport

Catches for these three fisheries are reported in Table 1.1.

Table 1.1.–Annual catch and hatchery add-on for AABM fisheries expressed in thousands of Chinook salmon.

Year	Southeast Alaska (T, N, S)			North ern British Columbia (T), Haida Gwaii (S)		West Coast Vancouver Island (T, S)	
	Treaty Catch		Hatchery Add-on[2]	Treaty Catch		Treaty Catch	
	Limit[1]	Observed		Limit[1]	Observed	Limit[1]	Observed
1999	184.2	198.8	47.7	126.1	84.3	107.0	38.5
2000	178.5	186.5	74.3	123.5	32.0	86.2	88.6
2001	250.3	186.9	77.3	158.9	43.3	145.5	120.3
2002	371.9	357.1	68.2	237.8	149.8	196.8	157.9
2003	439.6	380.2	57.2	277.2	194.8	268.9	173.6
2004	418.3	417.0	76.0	267.0	241.5	209.6	215.3
2005	387.4	388.6	64.3	240.7	243.6	179.7	199.5
2006	354.5	360.1	48.4	200.0	216.0	145.5	145.5
2007	259.2	328.2	68.4	143.0	144.2	121.9	140.6
2008	152.5	172.8	66.1	120.9	95.6	136.9	145.7
2009[3]	176.0	228.0	61.9	139.1	109.5	91.3	124.6
2010	215.8	230.8	53.4	160.4	136.6	142.3	139.0
2011	283.3	290.7	65.6	186.8	122.7	134.8	204.2
2012	205.1	242.5	51.4	149.5	120.3	113.8	134.5
2013	284.9	191.4	65.6	220.3	115.9	178.8	113.6
2014	378.6	435.2	56.6	262.6	216.9	191.7	188.4
2015	337.5	337.8	67.3	246.6	158.9	179.7	113.3
2016	355.6	TBA	TBA	248.0	TBA	133.3	TBA

Note: T = Troll, N = Net and S = Sport fisheries.

[1] Allowable treaty catches corresponds to the first postseason abundance index for years 1999 to 2015 and the preseason abundance index for 2016.

[2] Treaty catch does not include hatchery add-on or exclusions (see Table A1).

[3] 2009 was the first year the 2009 Agreement was implemented.

1.1.1 Southeast Alaska Fisheries

The SEAK Chinook salmon fishery is managed to achieve the annual all-gear PST allowable catch associated with the preseason abundance index, which is generated by the PSC Chinook model each spring. Catch is allocated through regulations established by the Alaska Board of Fisheries among troll, net, and sport fisheries. The current allocation plan reserves 4.3% of the total all-gear catch for purse seine, 2.9% for drift gillnet, and 1,000 fish for set gillnet fisheries. After the net quotas are subtracted, 80% of the remainder is allocated to the commercial troll fishery and the other 20% to sport fisheries. The commercial troll and net fisheries are managed inseason according to procedures outlined in gear-specific management plans. Sport fishery bag and possession limits as well as annual limits are established prior to the season based on the preseason abundance index. The regulatory history and maps for each SEAK fishery are presented in CTC 2004b. In addition, the SEAK AABM fishery is managed for the following:

(1) an Alaska hatchery add-on (CTC 1992) and exclusion of Chinook salmon catches in selected terminal areas (CTC 2004b)

(2) compliance with provisions established by the National Marine Fisheries Service (NMFS) in accordance with the US Endangered Species Act (ESA)

(3) consistency with the provisions of the PST as required by the Salmon Fishery Management Plan of the North Pacific Fishery Management Council that was established by the US Magnuson-Stevens Act

The preliminary total all-gear catch in 2015 was 405,331, with a PST catch of 337,794, an Alaska hatchery add-on of 67,320, and a terminal exclusion catch of 216 Chinook salmon. The postseason allowable catch for the all-gear SEAK AABM fishery is 337,300. SEAK Chinook salmon catch from 1975 to 2015 are reported in Table A1.

1.1.1.1 Troll Fisheries Catch

The troll fishery accounting year began with the start of the winter fishery on October 11, 2014, and ended with the summer fishery in July 2015. The winter troll fishery continues until 45,000 Chinook salmon are caught, or through April 30, whichever is earlier. In 2015, the winter troll fishery was open through March 25. The spring fishery, which is managed to maximize the harvest of Alaska hatchery-produced Chinook salmon, was conducted from April 16 to June 30 in a total of 33 spring areas and five terminal harvest areas. There is no cap on the number of Chinook salmon that can be harvested in the spring troll fishery. The percentage of Alaska hatchery fish in each area is monitored on a weekly basis and only areas that meet predefined thresholds are left open. The 2015 summer troll fishery included only one Chinook salmon retention period which occurred from July 1 to July 8. In recent years, a small portion of the troll fleet has targeted chum salmon from mid-June through August, resulting in a decrease in effort directed at Chinook and coho salmon (Skannes et al. 2013).

In 2015, the troll fishery harvested 269,814 Chinook salmon, which included 22,087 Alaska hatchery fish. There was an Alaska hatchery add-on of 18,476 and a terminal exclusion catch of 216 fish, and subtraction of these from the total harvest results in a total of 251,122 PST fish. The winter fishery harvested 50,673 fish, of which 2,027 were from Alaska hatcheries and 46,983 were PST fish. The spring fishery caught a total of 54,476 fish, of which 15,761 were Alaska hatchery fish and 41,069 were PST fish. The total summer catch was 164,665, of which 4,310 were from Alaska hatcheries and 161,070 were PST fish (Table 1.2).

Table 1.2 –Harvest of Chinook salmon in Southeast Alaska by gear type in 2019.

Gear	Total Catch	Alaska Hatchery Catch[1]	Alaska Hatchery Add-on[1]	Terminal Exclusion Catch[2]	Available Catch[3]
Troll					
Winter	55,675	3,017	1,498	0	55,156
Spring	54,878	15,761	11,195	238	43,683
Summer	208,663	8,210	5,188	0	203,475
Troll subtotal	299,216	26,987	18,879	238	304,314
Sport[4]	91,409	16,124	11,918	0	87,285
Net					
Set Net	862			0	862
Drift gillnet	22,881	17,318	16,818	0	6,068
Seine	35,265	18,180	18,019	0	11,762
Net subtotal	59,008	35,498	34,837	0	18,692
Total	449,633	78,609	65,635	238	510,386

[1] The add-on is the total estimated Alaska hatchery catch, minus 1,258 base period Alaska hatchery catch, and minus the risk adjustment (product of standard error for the total estimated Alaska hatchery catch and a risk factor of 1.645).
[2] Terminal exclusion catch is a result of the harvest sharing arrangement on the Taku and Stikine rivers.
[3] Treaty catch is the total catch minus Alaska hatchery add-on minus terminal exclusion catch. Totals may not equal the sum of the individual values due to rounding.
[4] Preliminary values until mail-out survey results are available.

1.1.1.2 Net Fisheries Catch

There are three types of commercial net fisheries conducted in SEAK: purse seine, drift gillnet, and set gillnet. With the exception of directed gillnet harvests of Chinook salmon in SEAK terminal areas as provided in the Transboundary Rivers chapter of the PST, harvests of Chinook salmon in net fisheries are incidental to the harvest of other species. The 2019 total net catch was 59,708 Chinook salmon, including 35,498 Alaska hatchery fish. There was an Alaska hatchery add-on of 34,837 and a terminal exclusion catch of 0, resulting in a PST catch of 18,692 (Table 1.2).

The purse seine fishery is open from mid-June through early fall and is limited to specific areas and time periods established inseason by emergency order (Gray et al. 2019a). In 2019, the purse seine fishery harvested a total of 35,265 Chinook salmon, which included 18,180 Alaska hatchery fish and an Alaska hatchery add-on of 18,019, resulting in a PST catch of 11,762 (Table 1.2).

The drift gillnet fishery usually opens in late June, unless directed fishing is implemented in May to target surplus production of Chinook salmon bound for the Taku and Stikine rivers (Gray et al. 2019b) as detailed in Chapter 1 of the 2019 Agreement. In 2019, preseason terminal run forecasts for both the Taku and Stikine rivers did not provide for an allowable catch, therefore no directed fisheries occurred. The SEAK drift gillnet fishery is limited to five traditional areas and time periods are established inseason by emergency order (Gray et al. 2019b). The 2019 drift gillnet fishery caught a total of 22,881 Chinook salmon, including 17,318 Alaska hatchery fish. There was an Alaska hatchery add-on of 16,818 and a terminal exclusion catch of 0, resulting in a PST catch of 6,068.

The net gillnet fishery is managed to catch no more than [illegible] Treaty Chinook salmon, a limit which is based on an historic average. This fishery is open during the late spring and summer in the fishoted area. The 2015 net gillnet fishery caught [illegible] Chinook salmon, all of which were [illegible] fish.

5.5.5.3 Sport Fishery Catch

Sport catches are monitored inseason by catch surveys throughout the region and sampling programs are in place to recover coded wire tags (CWTs) from stagged Chinook salmon. The number of Wasko hatchery fish caught is estimated from the CWTs collected by the sampling program. Preliminary sport catch estimates are computed from the catch surveys while final sport catch estimates are computed from a mail out survey and are available one year after the fishery occurs. In 2015, the management plan required a daily bag limit of three Chinook salmon 71 cm (28 inches) or greater in length for resident angler during May and June and 1 fish daily as of July 1, 2015. The nonresident angler daily bag limit was two fish during May and June and one fish thereafter. The nonresident annual limit was six Chinook salmon during May and June which was reduced to three Chinook salmon as of July 1. In addition, residents were allowed to use two rods from October through March. In some designated harvest areas that hatchery release sites, bag and possession limits and annual limits were liberalized to provide increased catches of returning Wasko hatchery Chinook salmon. The preliminary 2015 total sport Chinook salmon catch was [illegible] with an estimate of [illegible] Wasko hatchery fish. There was an Wasko hatchery add-on of [illegible] fish, resulting in a catch of [illegible] Treaty Chinook salmon (Table 1.3).

5.5.6 British Columbia Fisheries

The [illegible] fishery includes [illegible] troll catch in Statistical Areas 1-4 and [illegible] sport catch in Statistical Areas 1 and 3. The total [illegible] catch in 2015 was [illegible]. The [illegible] fishery includes the [illegible] commercial and First Nations troll and a portion of the [illegible] sport fishery (defined below). The total [illegible] catch in 2015 was [illegible] (Table 1.3).

5.5.6.1 Northern British Columbia Adults

The total [illegible] catch (troll plus sport) between October 1, 2014 and September [illegible], 2015 was [illegible] Chinook salmon (Table 1.3).

Table 1.3 Harvest of Chinook salmon by year for Northern British Columbia [illegible] fisheries in 2015

[illegible] Fishery	Landed Catch	Legal Fisheries	Sublegal Fisheries
Troll			
Summer	[illegible]	[illegible]	[illegible]
[illegible] Troll	[illegible]	[illegible]	[illegible]
Troll subtotal	[illegible]	[illegible]	[illegible]
Sport	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

5.3.2.3.3 Non-Prison Services Contracting Profit Potential Cases

The MDC Cost Estimate Model (MEM) FY2 Forecast adjusts coverage percentage for Forecast adjusted Nothing From Loss (0 to 100, 50 just from Hogan, 0 to Saskatchewan, 100, 2010). The actions 2010 MEM cost Estimate was constructed under a system of individual non-Minerva access. 38 hundredths of Forecast adjusted caught in the MEM cost Estimate were made in Saskatchewan hundredths later and whether were attributed to an independent contractor. Calculations of hundredths that accounted since 2000, a range of 0.0 hundredths were issued. But the model which was revised by 37 should necessarily result of the quote was transferred out. Manitoba Hydro and Sunset House were transferred to the cost Estimate and the contractor was then sole 37 to 100 hundredths (0 to 1). The cost Estimate were constructed in 2010. In Alberta hundredths amounts caught in Sunset and from Sunset Point to Hyde Shore on Stuart were included the contractor cost Estimate from areas within one hundred miles of the shore from Loss (0 to September 10, 2010).

5.3.2.3.4 Non-Prison Services Contracting Space Potential Costs

Space caught Forecast adjusted from Hyde Sunset (Pacific Forestry Management Area 1), 1, 100, 200 and 300 was included in the MEM Costs. Operation in the Hyde Sunset space Potential have been estimated since 2000 through bridge replacement programs, road surveys, and independent observations by Canadian Department of Fisheries and Oceans (DFO) staff. The 2010 Hyde Sunset space which was 10,200 Forecast adjusted.

5.3.2.3.5 Sunset Cases Contracting Sunset Costs

Under the 2008 FFT agreement, the MDC MEM Forestry includes the MDC cost and the contract MDC space Forestry distribution network. The cost MEM is a the contract cost, contract cost space, and the Business cost is 2010 was 1,000 FF Forecast adjusted (Table 5.3).

Table 5.3: – Summary of Forecast adjusted by space (in Sunset Cases Contracting Sunset MEM/Contract, 2010)

MDC Forestry	Contract Cost	Space Potential	Contract Potential
Total			
Sunset	2,000	1	200
Spring	2,100	1	2,100
Summer	2,100	1	210
Total, Sunset, and Contracting	2,300	3/2	3/2
Sunset cost	2,300	3/2	3/2
Total cost	2,300	300	1
Total contract	38,210	2,210	2,300
Sunset	38,210	2,210	2,210
Contract	38,210	38,210	38,210

5.3.2.3.6 Sunset Cases Contracting Cost of Profit Potential Costs

The MEM cost which includes the contract cost and the Business cost caught Forecast adjusted in Pacific Forestry Management Areas (1), 100 (2), and 200 (3) in the 2010 season (Table 5.3). 2010 is September 10, 2010). MEM cost Estimate based on the same contract cost 2,300

[illegible]

[illegible]

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[illegible]

Table 1.5.—Estimates of treaty and total (includes total treaty, terminal exclusion, and hatchery add-on catch and estimates of incidental mortality) landed catch (LC), incidental mortality (IM, in nominal numbers of fish), and total mortality (TM) in SEAK AABM fishery, 2015.

SEAK Fishery	LC	Legal Encounters	Sublegal Encounters	Total LNM[1]	Total SNM[1]	Total IM	Total Mortality
Treaty							
Troll CR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Troll CNR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Troll Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sport Total[2]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gillnet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seine CR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seine CNR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Net Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Treaty Total	[illegible]	[illegible]	[illegible]	[illegible]			
Total SCNR							
Troll CR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Troll CNR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Troll Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sport Total[2]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gillnet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seine CR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seine CNR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Net Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SCNR Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[1] Includes dropoff mortality. LNM = Legal Incident Mortality, SNM = Sublegal Incident Mortality.

[2] Catch data are preliminary estimates from creel survey expansions. IM for the SEAK sport fishery is estimated from the preliminary LC and the previous year IM to LC ratios. Final estimates are available from mail-out surveys in October one year after fishing season and will be reported in Table K1 and Table K2 of the next annual Catch and Escapement Report.

1.2.2 British Columbia Fisheries

1.2.2.1 Northern British Columbia Fisheries

Table 1.6 summarizes estimates of LC, encounters and associated IM by size class during CR and CNR fishing periods for the 2015 NBC AABM fishery. Releases of Chinook salmon from the NBC troll fishery are based on logbook data. Encounters from the QCI sport fishery are based on creel survey and logbook programs. IM estimates were derived using gear- and size-specific rates from the CTC (2007). The estimated TM for 2015 was 180,576 nominal fish, which included 158,303 LC, and 21,673 IM.

1.2.2.2 West Coast Vancouver Island Fisheries

The estimated TM of Chinook salmon for the 2015 WCVI AABM fishery was 127,707 nominal fish, which included 106,737 LC and 10,970 IM (Table 1.6). The estimated IM included 20,925 legal and 12,448 sublegal nominal Chinook salmon. Table 1.6 also summarizes encounters for these fisheries by size class during CR and CNR fisheries.

Table 1.6.–Estimates of treaty and total landed catch (LC), incidental mortality (IM; in nominal numbers of fish), and total mortality (TM) in NBC and WCVI AABM fisheries, 2015.

Fishery	LC	Legal Releases	Sublegal Releases	LIM[1] Drop-off	Total LIM[1]	Total SIM[1]	Total IM	Total Mortality
NBC								
Troll CR	106,703	8932	5,843	1,814	3,618	1,385	5,003	111,706
Troll CNR	0	9,029	5,907	-	1,824	1,400	3,224	3,224
Troll Total	106,703	17,961	11,750	1,814	5,442	2,785	8,227	114,930
Sport Total	52,200	72,749	0	1,879	13,446	0	13,446	65,646
NBC Total	158,903	90,710	11,750	3,693	18,888	2,785	21,673	180,576
WCVI								
Troll CR								-
Troll CNR	54,338	82	3,933	924	940	932	1,872	56,210
First Nations Troll[2]	0	0	0	0	0	0	-	-
First Nations EO Troll[3]	14,168	996	0	241	442	0	442	14,626
Troll Total	68,522	1,078	3,933	1,165	1,382	932	2,314	70,836
Sport Total	48,215	19,243	8,515	3,327	7,021	1,635	8,656	56,871
WCVI Total	116,737	20,321	12,448	4,492	8,403	2,567	10,970	127,707

[1] LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.
[2] First Nations troll includes food, social, and ceremonial and Maa-nulth Treaty catch.
[3] First Nations economic opportunity (EO) troll is the T'aaq-wihak fishery.

1.3 Review of Individual Stock Based Management Fisheries

ISBM fisheries include all British Columbia Chinook salmon fisheries that are not included in the NBC and WCVI AABM fisheries, and all marine and freshwater Chinook salmon fisheries in Washington and Oregon. ISBM fisheries are managed with the intent of meeting management objectives for individual stocks listed in Attachments IV and V in Chapter 3, Annex IV, of the PST.

1.3.1 Canadian Individual Stock Based Management Fisheries

The Canadian ISBM fisheries include all fisheries that catch or release Chinook salmon in British Columbia that are not AABM fisheries. Catches of Taku River and Stikine River Chinook salmon occurring in Canada are also provided, although provisions for catch sharing arrangements between Canada and the US for these two Transboundary River stocks are described in Chapter 1 of the 2009 Agreement. ISBM obligations are not applicable to these stocks since they are not identified in the Attachments to Chapter 3. In 2015, a total of 281,532 nominal fish were caught in Canadian ISBM fisheries in British Columbia and Canadian sections of the Transboundary Rivers. Total estimated IM in 2015 was 31,732 legal and 11,920 sublegal Chinook salmon. The distribution of LC and estimated IM are presented in Table 1.7.

Table 1.7.–Landed catch and incidental mortalities in Canadian ISBM fisheries for 2015.

Region/Gear	Landed Catch	Release Legals	Release Sublegals	Total LIM[1]	Total SIM[1]	Total Mortality
Transboundary Rivers	**6,836**	**48**		**329**	**0**	**7,165**
Net	5,385			248	0	5,633
Freshwater Sport	225	48		25	0	250
First Nations-FSC[2]	1,226			56	0	1,282
Northern British Columbia	**36,910**	**2,309**		**3,636**	**0**	**40,546**
Net	2,434	2,300		2,090	0	4,524
Tidal Sport	12,760			459	0	13,219
Freshwater Sport	3,442			237	0	3,679
First Nations-FSC	17,524			806	0	18,330
Tyee Test Fishery	750	9		43	0	793
Central British Columbia	**19,998**	**1,527**	**0**	**1,967**	**0**	**21,965**
Net	5,351	1,527		1,370	0	6,721
Tidal Sport	10,597			381	0	10,978
Freshwater Sport	1,270			88	0	1,358
First Nations-FSC	2,780			128	0	2,908
Troll	0	0	0	0	0	0
West Coast Vancouver Island	**54,542**	**11,218**	**6,112**	**5,722**	**1,174**	**61,437**
Net	10,131	362		751	0	10,882
Tidal Sport	34,668	10,856	6,112	4,476	1,174	40,318
First Nations-EO[3]	7,724			355	0	8,079
First Nations-FSC	2,019			139	0	2,158
Johnstone Strait	**12,246**	**3,607**	**6,272**	**2,153**	**1,204**	**15,603**
Net	54	1,162		848	0	902
Tidal Sport	11,931	2,445	6,272	1,293	1,204	14,428
First Nations-FSC	261			12	0	273
Georgia Strait	**59,460**	**6,573**	**31,674**	**5,372**	**6,081**	**70,914**
Net	0	13		10	0	10
Tidal Sport	59,460	6,543	31,674	5,359	6,081	70,900
First Nations-FSC	0			0	0	0
Troll	0	17		3	0	3
Juan de Fuca	**41,309**	**10,528**	**18,023**	**6,254**	**3,460**	**51,024**
Net	17	2,610		1,885	0	1,902
Tidal Sport	41,292	7,918	18,023	4,369	3,460	49,122
Fraser River	**50,231**	**10,704**		**6,300**	**0**	**56,531**
Commercial Net	104	129		127	0	231
First Nations-EO Net	2,515	1,481		1,517	0	4,032
First Nations-FSC Net	24,693	73		1,205	0	25,898
Mainstem Catch Sport	13,899	1,814		1,307	0	15,206
Test Fishery Net	4,432	318		505	0	4,937
Trib Catch Sport	4,588	6,889		1,639	0	6,227
Grand Total	**281,532**	**46,514**	**62,081**	**31,732**	**11,920**	**325,184**

[1] LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.
[2] FSC = food, social, and ceremonial.
[3] EO = economic opportunity.

1.3.2 Southern US Individual Stock Based Management Fisheries

Southern US fisheries of interest to the PSC, generally those north of Cape Falcon, Oregon, are managed in accordance with legal obligations stemming from treaties between Indian tribes and the US, and where relevant, the conservation constraints set by the ESA. In 1974, *US v. Washington* set forth sharing obligations to meet treaty fishing rights in western Washington. Treaty rights of Columbia River tribes were defined by *US v. Oregon*, and the Columbia River Fisheries Management Plan was implemented in 1977. In reporting, these fisheries are termed *treaty Indian* if they are fishing under the Native American Treaty fishing rights and *non-Indian* otherwise. Currently, all southern US fisheries are ISBM fisheries (Table 1.8). Historical catches in these fisheries are provided in Table A16 through Table A22.

Table 1.8.–Landed catch and incidental mortality in Southern US troll, net, and sport fisheries, 2013–2015.

		2015[1]			2014			2013		
Fishery	**Gear**	**LC**	**Release**	**IM**	**LC**	**Releases**	**IM**	**LC**	**Releases**	**IM**
Juan de Fuca	Net	828	NA	66	1,314	NA	105	449	NA	36
	Sport	13,271	32,253	10,568	11,059	26,877	8,807	14,900	59,364	18,070
	Troll	4,771	NA	119	4,512	NA	113	3,295	NA	82
Total		**18,870**	**32,253**	**10,754**	**16,885**	**26,877**	**9,025**	**18,644**	**59,364**	**18,188**
San Juans	Net	4,517	7,928	6,704	6,666	5,711	5,102	3,908	12,160	10,041
	Sport	8,158	8,040	3,338	9,208	9,075	3,767	9,502	8,266	3,593
Total		**12,675**	**15,968**	**10,042**	**15,874**	**14,786**	**8,869**	**13,410**	**20,426**	**13,634**
Puget Sound	Net	55,959	NA	4,477	50,106	NA	4,008	105,136	NA	8,411
	Sport	35,155	66,891	23,024	23,911	45,496	15,660	36,276	62,066	21,894
Total		**91,114**	**66,891**	**27,501**	**74,017**	**45,496**	**19,668**	**141,412**	**62,066**	**30,304**
Wash. Inside Coastal	Net	32,494	NA	650	39,514	NA	790	31,111	NA	622
	Sport	9,858	NA	680	9,740	NA	672	10,188	NA	703
Total		**42,352**	**0**	**1,330**	**49,254**	**-**	**1,462**	**41,299**	**-**	**1,325**
Columbia River–Spring	Net	70,094	3738	3,149	47,030	2,182	2,022	21,455	1037	934
	Sport	82,478	5,935	6,871	59,242	8,250	5,729	30,561	3,215	2,748
Summer	Net	41,985	0	1,260	22,332	-	670	15,591	0	468
	Sport	5,989	1,629	614	1,248	11,366	1,484	1,075	9,826	1,283
Fall	Net	360,335	0	10,810	383,877	-	11,516	341,464	0	10,244
	Sport	116,220	51,530	17,913	117,313	48,060	17,322	123,005	39,070	15,989
Total		**677,101**	**62,832**	**40,617**	**631,041**	**69,858**	**38,743**	**533,151**	**53,148**	**31,665**
WA/OR North Falcon	Sport	42,179	15,219	3,422	42,327	26,578	5,130	30,837	32,048	5,640
	Troll	125,384	NA	3,135	116,489	NA	2,912	91,915	NA	2,298
Total		**167,563**	**15,219**	**6,556**	**158,816**	**26,578**	**8,042**	**122,752**	**32,048**	**7,938**
Oregon Inside	Sport[2]	49,250	NA	3,398	46,919	NA	3,237	46,247	NA	3,191
	Troll[3]	1,156	NA	29	847	NA	21	1,188	NA	30
Total		**50,406**	**0**	**3,427**	**47,766**	**-**	**3,259**	**47,435**	**-**	**3,221**
GRAND TOTAL		**1,060,081**	**193,163**	**100,226**	**993,653**	**183,595**	**89,068**	**918,103**	**227,051**	**106,275**

Note: NA = Not available.

[1] Washington Department of Fish and Wildlife Catch Record Card estimates of LC were not yet available; LC and releases for 2015 were computed using 2010–2014 mean values.

[2] Values for 2015 LC and IM are estimates based on averages, not actual observed values. These will become available after the timeframe required for this report.

[3] The value represented by Troll is the concentrated fishery off of the mouth of the Elk River which is designed to specifically exploit returning Elk River Chinook salmon.

1.3.2.1 Strait of Juan de Fuca and the San Juan Islands

The preliminary estimate of the 2015 Chinook salmon catch in Strait of Juan de Fuca (Area 4B, 5, 6, and 6C) net fisheries was 828 fish with the majority of these taken during fisheries targeting Fraser River sockeye salmon. There were 4,517 Chinook salmon harvested in the San Juan Islands net fisheries (Area 6A, 7, and 7A). The preliminary estimate of the 2015 Strait of Juan de Fuca treaty Indian troll fishery catch (through December 2015) is 4,771Chinook salmon. The catch estimate does not include catches from Area 4B during the May to September Pacific Fisheries Management Council management period. Historic catch estimates are provided for the Strait of Juan de Fuca (Table A16) and San Juan areas (Table A17).

1.3.2.2 Puget Sound

The preliminary estimate of the net fishery harvest of Chinook salmon in Puget Sound marine and freshwater areas (excluding Strait of Juan de Fuca and the San Juan Islands) in 2015 is 55,959 (52,637 treaty Indian, 3,322 non-Indian). The harvests in treaty Indian fisheries include a preliminary estimate of 18,100 Chinook salmon in inriver fisheries. Estimates of the sport catch in 2015 are not yet available from the Washington Department of Fish and Wildlife (WDFW) Catch Record Card accounting system; thus, the preliminary estimate of sport catch reported here for 2015 is an average of the previous three years (35,155). Historic catch tables for Puget Sound (exclusive of the Strait of Juan de Fuca and San Juan Islands) are provided in Table A18.

1.3.2.3 Washington Coast Terminal

The harvest in Washington coastal net fisheries was 32,494 Chinook salmon. Harvest in treaty Indian fisheries include 17,323 harvested in north coastal rivers (Quinault, Queets, Hoh, and Quillayute rivers) and 10,269 in Grays Harbor and the Humptulips and Chehalis rivers within the basin. The 2015 non-Indian commercial net harvest was 62 Chinook salmon in Grays Harbor and 4,840 from Willapa Bay.

From Grays Harbor north, sport fisheries were implemented based upon preseason state–tribal agreements and were subject to inseason adjustment. Estimates of sport fishery catches for Washington coastal terminal fishing areas in 2015 are not yet available from the Catch Record Card accounting system, but are approximated here based on the average catch from the previous three years. Historic catch estimates for Washington Coastal inside fisheries are shown in Table A19.

1.3.2.4 North of Cape Falcon

Ocean fisheries off the coasts of Washington, Oregon, and California are managed under regulations recommended by the Pacific Fishery Management Council. The fisheries north of Cape Falcon also fall under the jurisdiction of the PST. For 2015, the estimated catch of Chinook salmon in commercial troll fisheries from Cape Falcon, Oregon, to the US-Canada border was 125,384 for non-Indian and treaty Indian fisheries combined. Estimated catch in the ocean sport fishery north of Cape Falcon in 2015 was 42,179 Chinook salmon. Historic catch estimates for US ocean fisheries north of Cape Falcon are shown in Table A20.

1.3.2.5 Columbia River

Chinook salmon from the Columbia River are divided into eight stock groups for management purposes. These groups are delineated by run timing and area of origin: (1) spring run originating below Bonneville Dam, (2) spring run originating above Bonneville Dam, (3) summer run originating above Bonneville Dam, (4) fall run returning to Spring Creek Hatchery, (5) fall run originating in hatchery complexes below Bonneville Dam, (6) wild fall run originating below Bonneville Dam, (7) Upriver Bright fall run, and (8) Mid-Columbia Bright fall hatchery fish.

When comparing the IM estimates in Table 1.8 and Table A21 with IM from *US v. Oregon* Technical Advisory Committee, WDFW, Oregon Department of Fish and Wildlife (ODFW), and Columbia River Intertribal Fish Commission (CRITFC) reports, readers should keep the following in mind.

(1) The Columbia River fishery management agencies include release mortality in some of their catch estimates whereas the tables in this report show LC in terms of retained fish only.

(2) Release mortality rates used by Columbia River fishery management agencies differ from those used by the CTC for this report.

(3) The tables in this report include estimates of IM from net dropout and hook and line dropoff, whereas the Columbia River fishery management agencies do not estimate this type of fishery related mortality.

In 2015, the total annual harvest for all fisheries (spring, summer, and fall, both hatchery and wild) in the Columbia River basin was 677,101 Chinook salmon. This included non-Indian commercial net plus Wanapum and Colville tribal harvest of 126,696; sport harvest of 204,687; and treaty Indian commercial, ceremonial, and subsistence harvest of 345,718 (Table A21). The 2015 total annual Columbia River combined net and sport harvest consisted of 152,572 spring Chinook, 47,974 summer Chinook and 476,555 fall Chinook (Table 1.8) salmon.

1.3.2.6 Oregon Coast Terminal

Most harvest in ocean fisheries off Oregon's coast is comprised of a mixture of southern Oregon and California Chinook salmon stocks not included in the PSC agreement. These stocks usually do not migrate north into the PSC jurisdiction to any great extent. Chinook salmon originating from Oregon streams north of Cape Blanco migrate north, and a majority of these populations are designated as the North Oregon Coast (NOC) aggregate and are included in the CTC Chinook model. On the mid-Oregon coast south of the NOC to north of Cape Blanco is a smaller population group designated as Mid-Oregon Coastal (MOC) aggregate populations. The NOC stocks are harvested only incidentally in Oregon ocean fisheries, while the contribution of MOC stocks to Oregon and Washington ocean fisheries is greater (based on CWT distribution data). Catch statistics for MOC are readily available for only one terminal ocean area troll fishery on a hatchery supplemented stock at the mouth of the Elk River. Late season (October to December) troll catch in the Elk River terminal troll fishery in 2015 was 1,156 Chinook salmon.

Sport catch of these two stock groups occurs primarily in estuary and freshwater areas as mature fish return to spawn, and catch is reported through a punch card accounting system.

These estimates become available more than two years after the current season. Therefore, inriver and estuary sport catch punch card estimates are only provided through 2014 for the NOC. The 2014 punch card estimate of estuary and freshwater catch for the NOC group is 46,919 Chinook salmon. However, catch projections have been made for 2015 using correlations between escapement and punch card catch estimates from past years; these preliminary estimates of terminal sport catch for 2015 are presented in Table 1.9. Historical catch estimates for the troll fishery targeting Elk River and the estuary and freshwater sport fisheries targeting on NOC stocks are shown in Table A22.

1.3.3 Estimates of Incidental Mortality for Southern US Fisheries

Table 1.8 shows estimates of IMs for southern US fisheries in marine and river fisheries in Puget Sound, on the Washington and Oregon coast north of Cape Falcon, Oregon coast terminal fisheries, and in the Columbia River fisheries. IM was calculated using the release mortality, drop-out, and drop-off mortality rates assigned for areas and gears in CTC (1997). Number of fish released is from creel interviews, voluntary trip reports, fishery monitoring, or extrapolated from similarly structured fisheries with known release information.

1.4 Summary of 2015 Coastwide Landed Catch, Incidental Mortality, and Total Mortality in PSC Fisheries

Table 1.10 provides a coastwide summary of Chinook salmon catches and estimates of IM and TM in PST fisheries for 2015. It should be noted, for some component fisheries, that current 2015 LC and IM are not yet available; the preliminary estimates of LC and IM will be updated in future reports as observed data become available.

The preliminary estimate of Treaty LC of Chinook salmon for all PST fisheries in 2015 is 1,955,047, of which 1,397,875 were taken in US fisheries and 557,172 were taken in Canadian fisheries (Table 1.9). Total estimated IM associated with this harvest is 223,089 nominal Chinook salmon (10% of the TM) in nominal fish. The TM for all PST fisheries in nominal fish was 2,178,136 Chinook salmon, which is approximately 114,000 less than recorded for 2014 (Table A25). Of the 2,178,136 total PSC TM estimated for 2015, 1,544,669 occurred in US fisheries and 633,468 occurred in Canadian fisheries. For US fisheries, 76% of the LC and 75% of TM occurred in ISBM fisheries; in Canada, 51% of the LC and 51% of TM occurred in ISBM fisheries. For some component sport fisheries, 2015 LC and IM estimates are not yet available. Data for calculating summary information contained in Table 1.10 for 2015 and previous years can be found in Table A23, Table A24, and Table A25.

Table 1.9.–Summary in nominal fish of preliminary estimates for landed catch (LC), incidental mortality (IM), and total mortality (TM) for US and Canada AABM and ISBM fisheries in 2015.

Fishery	2015		
	LC	IM	TM
SEAK AABM	337,794	46,567	384,361
SEAK hatchery add-on and terminal exclusion	67,537	20,817	88,354
US ISBM	1,060,081	100,226	1,160,308
US TOTAL[1]	1,397,875	146,793	1,544,669
NBC AABM	158,903	21,673	180,576
WCVI AABM	116,737	10,971	127,708
CANADA ISBM	281,532	43,652	325,184
CANADA TOTAL	557,172	76,296	633,468
PST FISHERIES TOTAL[1]	1,955,047	223,089	2,178,136

[1] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

2. Chinook Salmon Escapements

The Agreement established a Chinook salmon management program that

> *introduces catch regimes that are based on estimates of Chinook salmon abundance, that are responsive to changes in Chinook salmon production, that take into account all fishery induced mortalities and that are designed to meet MSY or other agreed biologically based escapement objectives...*

This chapter compares annual escapement estimates with MSY or other agreed biologically based escapement goals established for Chinook salmon stocks. The CTC has reviewed and accepted escapement goals for 22 stocks included in this report.

This annual report includes a section on the framework used for escapement assessments and narratives for each stock that include a description of escapement methodology, escapement goal basis, and agency comments.

Escapement goals accepted by the CTC were based on analyses that followed the guidelines developed in the CTC escapement goal report (CTC 1998). In the stock-specific narratives presented with the escapement graphs, only CTC-accepted escapement goals and ranges (in gray shading) are shown on the escapement graphs and used for evaluation. Table 2.1 presents the status of escapement goal reviews by the CTC for stocks identified as escapement indicator stocks.

2.1 Escapement Goal Assessments

The Agreement (Annex IV, Chapter 3, Paragraph 2.b.ii) directs the CTC to

> *report annually on the escapement of naturally spawning Chinook salmon stocks in relation to the agreed escapement objectives referred to below, evaluate trends in the status of stocks, and report on progress in the rebuilding of naturally spawning Chinook salmon stocks...*

Stock-specific graphs of escapements and commentaries are presented in this report to provide a perspective on stock status and escapement trends through 2015.

The escapement goals and 2014–2015 escapements for the 22 stocks with CTC-accepted escapement goals are listed in Table 2.2. For eight of these stocks, the escapement goal is defined as a range; for the remaining 14 stocks, the escapement goal is defined as a point estimate. In 2015, escapements were within or above the goal range for 7 stocks, above the range or Sum point estimate for 12 stocks, and below the goal for 3 stocks.

The CTC has now assessed the status of stocks with CTC-accepted goals for return years 1999–2015. Over this time period, the number of stocks with CTC-accepted goals has increased from 15 to 22 (Figure 2.1). From 1999 to 2015, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 50% to 98%. In 2015, the percentage of stocks that met or exceeded goal was 86%. Of the three stocks below goal, one stock (Cowichan) was within 15% of the target goal. Two stocks were more than 15% below goal: Situk and Queets spring/summer.

Table 2.1.—Pacific Salmon Commission Chinook salmon escapement indicator stocks.

Provisions in Treaty Attachments[1]					Stock Group (a, Attachment 1.1.2)	Escapement Indicator	Region[2]	Run
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
✓	✓		✓		North Central British Columbia	[illegible]	[illegible]	Summer
✓	✓		✓		North Central British Columbia	[illegible]	[illegible]	Spring/Summer
✓	✓		✓		North Central British Columbia	[illegible]	[illegible]	Spring/Summer
			✓		North Central British Columbia	[illegible]	[illegible]	Spring
						[illegible]	[illegible]	Spring/Summer
✓	✓		✓		SEAK/Yukon	[illegible], [illegible], [illegible], [illegible], [illegible], [illegible]	SEAK	Fall
✓	✓		✓		UNSC	[illegible], [illegible], [illegible], [illegible], [illegible]	UNSC	Summer/Fall
			✓		[illegible]	[illegible]	[illegible]	Fall
✓	✓		✓		Fraser Clarks / Gates/Ports	Fraser Spring [illegible]	[illegible]	Spring
✓	✓		✓		Fraser Clarks / Gates/Ports	Fraser Spring [illegible]	[illegible]	Spring
✓	✓		✓		Fraser Clarks / Gates/Ports	Fraser Summer [illegible]	[illegible]	Summer
✓	✓		✓		Fraser Clarks / Gates/Ports	Fraser Summer [illegible]	[illegible]	Summer
		✓	✓	✓	Fraser Late	[illegible]	[illegible]	Fall
			✓	✓	North Puget Sound National Springs	[illegible]	WCPS	Spring
			✓	✓	North Puget Sound National Springs	[illegible]	WCPS	Spring
		✓	✓	✓	Puget Sound National Summer/Fall	[illegible]	WCPS	Summer/Fall
		✓	✓	✓	Puget Sound National Summer/Fall	[illegible]	WCPS	Summer/Fall
		✓	✓	✓	Puget Sound National Summer/Fall	[illegible]	WCPS	Summer/Fall
		✓	✓	✓	Puget Sound National Summer/Fall	Lake Washington	WCPS	Summer/Fall
		✓	✓	✓	Puget Sound National Summer/Fall	[illegible]	WCPS	Summer/Fall
✓	✓			✓	Washington Coastal Fall National	[illegible]	WWCOAST	Fall
						[illegible]	WWCOAST	Summer
✓	✓			✓	Washington Coastal Fall National	[illegible]	WWCOAST	Fall

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Process & Tools Workforce[1]					Stock Group & Workforce	Occupational Indicator	Source[2]	Goal
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
						[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]	[illegible]	[illegible][3]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]
						[illegible]	[illegible]	[illegible]

[illegible] indicates that there is no [illegible] occupational goal.

[1] Refer to List of Acronyms for definitions.

[2] An occupational goal was established for the Coastline in 2005, a goal for Nanaimo in [illegible].

[3] The occupational indicator stocks listed in the stocks table for this group are Island Fraser, Middle Fraser, and Thompson. The Fraser River springboard group is split into these four occupational indicators to represent the stock group by the historic base rather than geographically.

[4] An occupational goal for Grays Harbor Mill was accepted by the LTC in February, [illegible].

Table 11.1: Occupation Cupola, 2004–2010 occupations, and 2004/04 escort (in escort-cuff-cf 75) occupation cupola

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

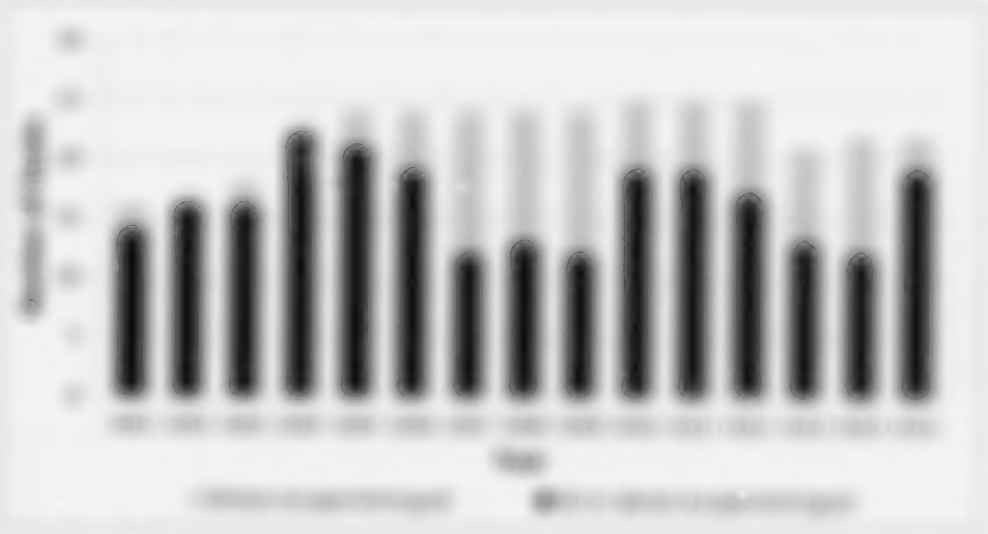

Figure 6.2 | Absolute cardiovascular disease uptake in ITU-accredited management units, 1990–2005

Note: Tile-level, difficult-to-reach, cardiac disease cases and prolonged ICU stays were analysed in a prospective cohort study in 1994 and 1995 (Kaplan-Meier 5-year survival, 0.78 versus 0.64, log-rank p = 0.004). Analysis of ward-level outcomes, using a pre-specified hierarchical model, found no significant difference in mortality (OR 0.91, 95% CI 0.74–1.12, p = 0.37) or length of stay (−0.6 days, 95% CI −1.4 to +0.2).

6.2 Trends in Cardiovascular Disease Uptake Across Units

The introduction of the assessment tunnel in Fellowship without rate increased in the 1990–2005 cross-series. Of management units using a tunnel, 41 (38%) had fellowship-trained staff, versus 12 of 31 (39%) amalgamated units. Crude mortality was 9.4 per 1,000 patient-days in fellowship units versus 11.2 per 1,000 in non-fellowship units, a difference of −1.8 per 1,000 (95% CI −3.9 to +0.3). After adjusting for case-mix and ward size, the difference was −0.7 per 1,000 (95% CI −2.1 to +0.7). This residual difference corresponds to a rate ratio of 0.93 (95% CI 0.79–1.09). Staff-reported confidence in their use of the tunnel, on a 5-point scale, was 3.8 in fellowship units versus 3.4 in non-fellowship units (difference 0.4, 95% CI 0.1–0.7). Staff who had attended a fellowship session rated it 4.1 versus 3.6 (difference 0.5, 95% CI 0.2–0.8). The effect was larger among those who had also completed a tunnel refresher (4.4 versus 3.6, difference 0.8, 95% CI 0.4–1.2), suggesting that exposure to both the training and the tool mattered more than either alone.

Mortality was lowest in units where the tunnel was used for more than 60 minutes per week (8.1 per 1,000 patient-days) and highest in units where it was used for less than 15 minutes per week (12.6 per 1,000 patient-days), a difference of −4.5 per 1,000 (95% CI −7.2 to −1.8). Units that used the tunnel for more than 60 minutes per week were also more likely to have a fellowship-trained lead (68% versus 31%). The interaction between fellowship training and tunnel use was −1.1 per 1,000 (95% CI −3.0 to +0.8), consistent with a multiplicative rather than additive effect. Units with both a fellowship-trained lead and a tunnel used for more than 60 minutes per week had a rate ratio of 0.71 (95% CI 0.58–0.87) versus units with neither, corresponding to an absolute difference of −2.9 per 1,000 (95% CI −4.6 to −1.2). Length of stay was 0.4 days shorter in fellowship units (6.2 versus 6.6, difference −0.4, 95% CI −0.9 to +0.1), with a rate ratio of 0.94 (95% CI 0.91–0.98). Readmission within 28 days was 14% in fellowship units versus 16% in non-fellowship units (difference −2 percentage points, 95% CI −4 to +1), with a rate ratio of 0.88 (95% CI 0.74–1.05). Staff turnover was 18% in fellowship units versus 22% in non-fellowship units (difference −4 percentage points, 95% CI −9 to +1), with a rate ratio of 0.82 (95% CI 0.61–1.10). Sensitivity analysis excluding units with fewer than 20 admissions (n = 9) left the fellowship effect unchanged (rate ratio 0.92, 95% CI 0.78–1.08). Stratifying by ward specialty (medical versus surgical) did not alter the direction of any estimate. Units in Kilbrennan, Tarbolton and Ardmore had the lowest baseline mortality (7.1 per 1,000) and the smallest tunnel effect (rate ratio 0.97, 95% CI 0.81–1.16), while units in Cowdenbeath and Glenrothes had the highest baseline mortality (14.3 per 1,000) and the largest effect (rate ratio 0.62, 95% CI 0.48–0.80).

5.5.5 Disappointment Towards the Visualization Results Results

The distribution of disappointment towards the visualization results differed significantly across the four conditions ($H(3) = 14.21$, $p = .002$, $\epsilon^2 = .095$). Participants in the Control condition reported the lowest average disappointment towards the visualization results ($M = 3.41$, $SD = 1.12$), followed by the Interactive condition ($M = 3.62$, $SD = 1.09$), the Static condition ($M = 3.84$, $SD = 1.05$), and the Interactive + Static condition ($M = 4.07$, $SD = 1.03$). Post-hoc Dunn's tests with Bonferroni correction showed that the difference between the Control and the Interactive + Static conditions ($p = .003$) and between the Interactive and the Interactive + Static conditions ($p = .041$) were significant, while the other pairwise comparisons were not significant ($p > .05$). Figure 5.21 illustrates the distribution of disappointment towards the visualization results across the four conditions.

Figure 5.21 Disappointment towards the visualization results across the four conditions. Error bars represent 95% confidence intervals.

Note: Higher values indicate greater disappointment. Dashed line marks the scale midpoint (3.0). The Control condition reported the lowest disappointment, while the Interactive + Static condition reported the highest.

5.5.6 Disappointment Towards the Interactivity Results

The distribution of disappointment towards the interactivity results differed significantly across the three conditions ($H(2) = 9.86$, $p = .007$, $\epsilon^2 = .066$). Participants in the Interactive condition reported the lowest average disappointment towards the interactivity results ($M = 3.29$, $SD = 1.14$), followed by the Static condition ($M = 3.71$, $SD = 1.08$), and the Interactive + Static condition ($M = 3.94$, $SD = 1.06$). Post-hoc Dunn's tests with Bonferroni correction showed that the difference between the Interactive and the Interactive + Static conditions ($p = .006$) and between the Interactive and the Static conditions ($p = .038$) were significant, while the difference between the Static and the Interactive + Static conditions ($p = .112$) was not significant. Figure 5.22 illustrates the distribution of disappointment towards the interactivity results across the three conditions.

Figure 5.22 Disappointment towards the interactivity results across the three conditions. Error bars represent 95% confidence intervals.

Note: Higher values indicate greater disappointment. Dashed line marks the scale midpoint (3.0). The Interactive condition reported the lowest disappointment, while the Interactive + Static condition reported the highest.

2.2.3 Escapement Trends for Canadian Stocks

Long-term rates of change in escapement for Canadian stocks were based on 1999–2015 time series of escapement for 16 of 17 stocks evaluated. Escapement time series started for Lower Shuswap in 2000 due to changes in escapement estimation methodologies. Few Canadian stocks exhibited clearly positive or negative tendencies in long-term rates of change in escapement—generally due to large variability in annual rates of change (as indicated by the 80% CIs; Figure 2.6). Seven stocks showed negative mean rates of change, but only Harrison, which has a CTC-agreed escapement goal, showed a clear negative trend. Stocks that showed a positive long-term rate of change in escapement include Fraser Summer 0.3, Warnock, and the WCVI 6-Stream Index. Chinook salmon from Fraser Summer 0.3, Harrison, Nanaimo, Warnock, and WCVI 6-Stream Index exhibited the lowest variability in annual rates of change in escapement, whereas Chinook salmon from Chuckwalla-Killbella, Fraser Spring 1.2, Fraser Spring 1.3, Fraser Summer 1.3, and Nicola exhibited the largest variability amongst all Canadian stocks. The highest annual long-term mean rate of change in escapement for a Canadian stock was 6.95% for Chinook salmon from the Warnock River, and the lowest mean rate of change in escapement was 12.11% for Chinook salmon from the Chuckwalla-Killbella aggregate.

Figure 2.6.–Long-term annual rates of change in escapements for Canadian Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. The color green in the squares indicate these stocks have CTC-accepted escapement goals, gray colored squares indicate the stocks do not have CTC-accepted escapement goals. Escapement time series for Nanaimo started in 2005 due to changes in escapement estimation methodologies.

2.2.4 Escapement Trends for Washington Stocks

The analysis of escapement trends for the period 1999–2015 revealed several noteworthy patterns for Puget Sound and Washington Coastal escapement indicator stocks (Figure 2.5). Of the seven Puget Sound indicator stocks, rates of change in escapement have declined significantly for three stocks (average annual rate of change −5.2% for the Stillaguamish, −5.0% for Snohomish) and increased significantly for one stock (+3.8% for Skagit Spring). CIs around the rates of change, as well as point estimates, for the remaining three Puget Sound indicator stocks indicate that escapements have not trended consistently in either direction. However,

due to widely varying escapements, there is considerable uncertainty around rate of change estimates for Skagit River summer/fall Chinook and Nooksack spring Chinook salmon. Although Puget Sound indicator stocks have largely met their agency management objectives (i.e., exploitation rate ceilings) for the time period under consideration, none of them have CTC-approved escapement goals against which trends can be considered. In contrast, one of the nine Washington Coast indicators stocks showed a significant trend in escapement for the 1999–2015 period (i.e., 80% CI inclusive of 0; absolute annual rate of change <5% for all). Rates of change in escapement have decreased significantly for the Hoh River fall stock (−2.8%). Six of the coastal indicator stocks have CTC-approved goals, which have been consistently met for summer/fall (Queets, Quillayute, Hoh), but not spring/summer (Hoh, Queets) run timing groups. Four of the stocks—Hoko, Hoh, Queets, and Grays Harbor—have wide CIs relative to other coastal indicator stocks. In the case of the Hoh and Queets spring/summer Chinook, despite regularly missing goals and returning at levels consistently lower than what was seen historically, the rates of change in escapement of these stocks were not significantly different from zero, which indicates that escapement is stable.

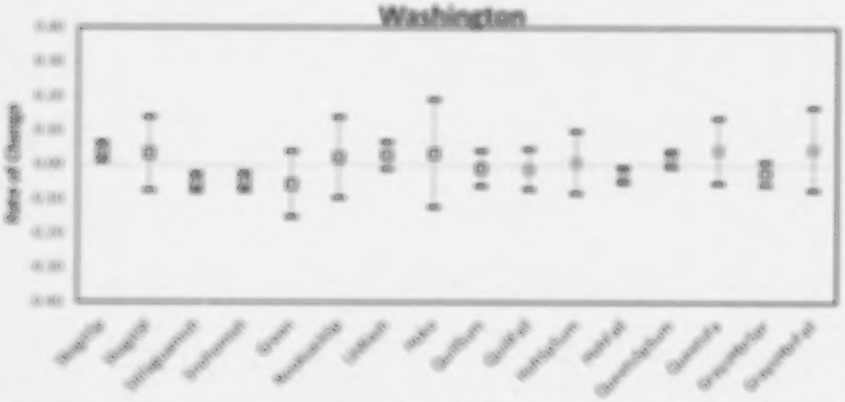

Figure 2.5.–Long-term annual rates of change in escapements for Washington Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. The color green in the squares indicate these stocks have CTC-accepted escapement goals, grey colored squares indicate the stocks do not have CTC-accepted escapement goals. The 2013 Nooksack spring escapement estimate was not available for this analysis.

2.2.5 Escapement Trends for Columbia River/Oregon Stocks

Long-term annual rates of change averaged 11% for the six Columbia River stocks, and ranged from 5.6% (Deschutes) to a high of 13.7% (Columbia Upriver Brights). During the same period, long-term annual rates of change for five Oregon Coast stocks averaged 4.8%, ranging from 2.4% for Siuslaw to 13.4% for Umpqua (Figure 2.6).

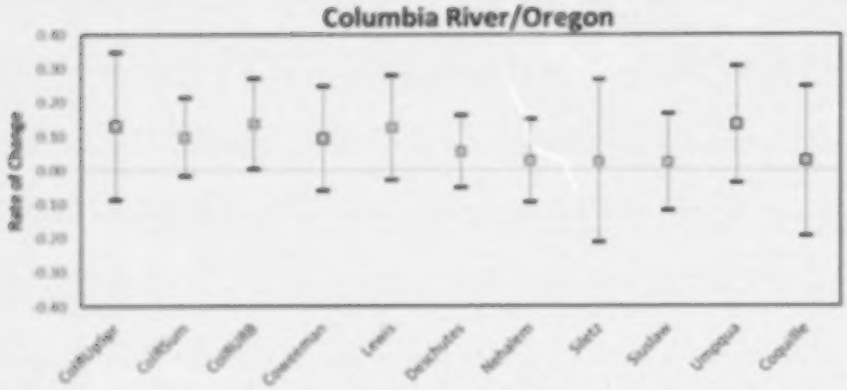

Figure 2.6.– Long-term annual rates of change in escapements for Columbia River/Oregon Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. The color green in the squares indicate these stocks have CTC-accepted escapement goals; grey colored squares indicate the stocks do not have CTC-accepted escapement goals.

2.3 Profiles for Escapement Indicator Stocks

Graphs of time series of escapements for Chinook salmon stocks are included in sections for Alaska, Canada, Puget Sound, Coastal Washington, Columbia River, and Oregon Coast. For each stock, there is a commentary describing the escapement methodology, escapement goal basis, escapement evaluation and agency comments. Escapement is usually reported in adults by calendar year (CY). All escapement goals accepted by the CTC are shown. Historical escapement and terminal run data are provided in the appendices for SEAK stocks (Table B1), TBR Stocks (Table B2), Canadian stocks (Table B3 to Table B6), Puget Sound (Table B7), Washington Coastal stocks (Table B8), Columbia River stocks (Table B9 and Table B10) and Oregon Coastal stocks (Table B11 and Table B12).

2.3.1 Southeast Alaska Stocks

There are four SEAK escapement indicator stocks. The Situk, Chilkat, Unuk, and Chickamin rivers include escapement estimates of large fish, defined as Chinook salmon equal to or greater than 660 mm length from mid eye to tail fork, and age 1.3 and older for the Chilkat stock. Estimates of large fish include mostly ocean-age-3, -4, and -5 fish, which include almost 100% of the females in the population, and do not include ocean-age-1 males. The length threshold criteria also contain a small proportion of ocean-age-2 fish. Survey methods have been standardized for these systems since 1975 except for the Chilkat River, which was standardized in 1991 concurrent with the initiation of mark–recapture (MR) escapement estimation. Escapement estimates for the Chickamin River are expanded aerial counts of large spawners. Biological escapement goals are in place for each of these stocks which contain an S_{MSY} point estimate and an escapement goal range.

The SEAK stocks can be classified into two broad categories, inside rearing and outside rearing,

based on ocean migration patterns. Outside-rearing stocks have limited marine rearing time in SEAK and are harvested primarily during their spawning migrations through marine waters in the spring; this includes the stock returning to the Situk River. Inside-rearing stocks include those vulnerable to SEAK fisheries as immature fish, as well as mature, migrating fish, and include stocks returning to the Chilkat, Unuk, and Chickamin rivers. Recoveries of CWTs originating from the Unuk River have also been reported in NBC fisheries. There is also some overlap within the inside/outside rearing classifications. All SEAK indicator stocks produce primarily yearling smolt except the Situk River, which produces around 90% subyearling smolt.

As a response to low abundance, a 15-year rebuilding program was established by the Alaska Department of Fish and Game (ADF&G) in 1981 (ADF&G 1981). At the same time, ADF&G established interim point escapement goals for all the SEAK stocks based on the highest observed escapement count prior to 1981. ADF&G has since performed more rigorous escapement goal analyses that have been reviewed and accepted by the CTC. ADF&G uses escapement goal ranges for management, as promulgated under the State of Alaska Policy for Statewide Salmon Escapement Goals and Policy for the Management of Sustainable Salmon Fisheries.

2.3.1.1 Situk River

The Situk River is a nonglacial system located near Yakutat, Alaska, that supports a moderate-sized, outside-rearing stock of Chinook salmon. Few Situk-origin Chinook salmon are caught in PST fisheries other than in directed sport, commercial, and subsistence fisheries located inriver, in the estuary, and in nearby marine waters. The fisheries that target this stock fall under a State of Alaska promulgated management plan directed to achieve escapements within the range.

Escapement Methodology: Escapements are based on weir counts minus upstream sport fishery harvests (if any), which are estimated from an onsite creel survey and a postseason mail-out survey. The weir has been operated annually since 1976, and was also operated from 1928 to 1955. Counts of large Chinook salmon are reported as the spawning stock. Jacks (ocean-age-1 and -2 fish) are also counted and, since 1989, jack counts (not included in Figure 2.7) have ranged between 1,200 and 4,000. ADF&G assessments of the Situk River escapements of Chinook salmon meet US and Bilateral CTC data standards and have continuously done so since 1976.

Escapement Goal Basis: In 1991, ADF&G revised the Situk River Chinook salmon escapement goal to 600 large spawners based upon a spawner–recruit analysis,[1] which was reviewed and adopted by the CTC. In 1997, ADF&G revised the Situk River escapement goal range to 500–1,000 large spawners to conform to ADF&G's escapement goal policy. The CTC reviewed and accepted this change in 1998. ADF&G changed the goal range to 450–1,050 large spawners in 2003; this proposed change was reviewed by the CTC in 2004 but not accepted.

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[1] Scott A. McPherson, ADF&G, to Keith Weiland, ADF&G. 1991 memorandum. Available from author, Douglas Island Center Building, 802 3rd Street, P. O. Box 240020, Douglas, AK 99824-0020.

Escapement Evaluation: Productivity of the Situk River stock has significantly declined over the last decade. Annual escapements less than 85% of the goal have occurred in four of the last eight years. The 2015 escapement was 174 large fish, a level below the PSC and ADF&G goal range. All terminal fisheries were closed in 2015 to pass as many fish through to escapement as possible. The 2015 escapement is the second lowest since 1976 and is close to the lowest escapement of 166 fish in 2010. There were no estimated harvests above the weir and this is an exact count of escapement (Figure 2.7).

Agency Comments: Situk River Chinook salmon has experienced poor natural survival in recent brood years. Harvest rates have been curtailed as a result; terminal directed fisheries were not prosecuted from 2010 through 2015, and incidental catches were also minimized through nonretention of Chinook salmon.

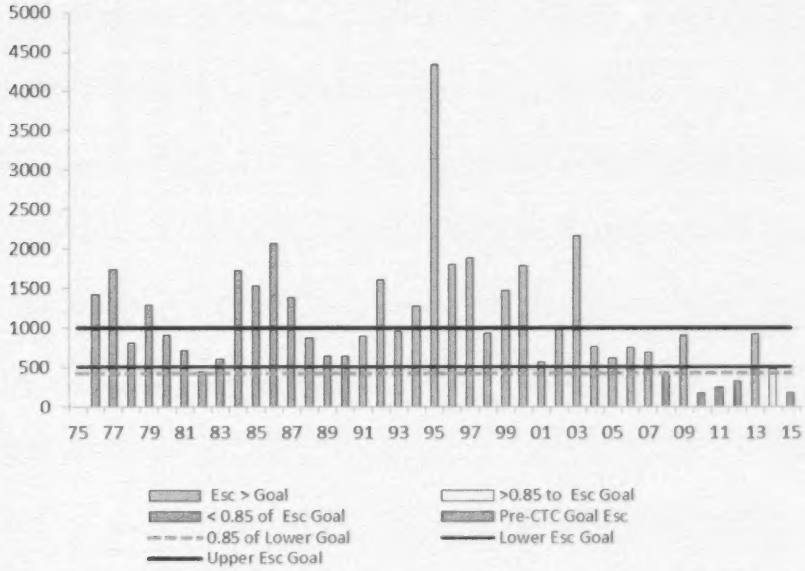


Figure 2.7.–Situk River escapements of Chinook salmon, 1976–2015.

2.3.1.2 Chilkat River

The Chilkat River is a moderate-sized glacial system located near Haines, Alaska, which supports an inside-rearing stock of Chinook salmon. Chilkat Chinook salmon smolt have had CWTs applied at relatively high rates (8–10%) beginning with the 1999 brood year; additional wild stock tagging occurred for three broods prior to that time. Relatively small terminal US marine sport and subsistence fisheries target this stock. This stock is also caught incidentally in sport and commercial drift gillnet and troll fisheries primarily in northern SEAK.

Escapement Methodology: Escapements are based on estimates of large spawners from a MR program conducted annually since 1991 (Ericksen and McPherson 2004). Escapement data are relatively precise with coefficient of variation (CV) for annual escapement estimates averaging about 15% since 1991. Since 1991, escapement assessments for Chilkat River Chinook salmon have continuously met US CTC data standards, and in most years have met CTC Bilateral data

standards. In 12 of the last 22 years the CV was 15% or less, with the highest CV of 21% in 1995. From 1975 to 1992, aerial survey counts were conducted on two small tributaries with relatively clear water; results from these estimates were inconsistent. Radio telemetry studies conducted in 1991 and 1992 found that spawners in these two tributaries represented less than 5% of the total escapement, and did not represent trends in abundance; therefore the aerial surveys were discontinued.

Escapement Goal Basis: The 1981 escapement goal was set at 2,000 large fish, based on an assumed fraction of the total escapement represented by the aerial survey counts. Ericksen and McPherson (2004) recommended a revised escapement goal range of 1,750–3,500 large Chinook salmon spawners, based on the MR estimates of escapement and limited CWT information available for this stock. This goal range was reviewed and adopted by ADF&G and the Alaska Board of Fisheries in 2003 and subsequently reviewed and accepted by the CTC in 2004.

Escapement Evaluation: The Chilkat River stock is reasonably healthy with annual escapements of at least 85% of the goal in all years except 2007. The 2015 escapement estimate was 2,456 (CV = 11%) large Chinook salmon, within the escapement goal range. This stock, like others in Alaska, has recently experienced a decline in productivity (Figure 2.8).

Agency Comments: Available CWT information on this stock suggests that exploitation is about 24% for recent brood years from the CTC exploitation rate analysis. Escapements since 1991 have been within or above the escapement goal range in all years except 2007 and 2012–2014.

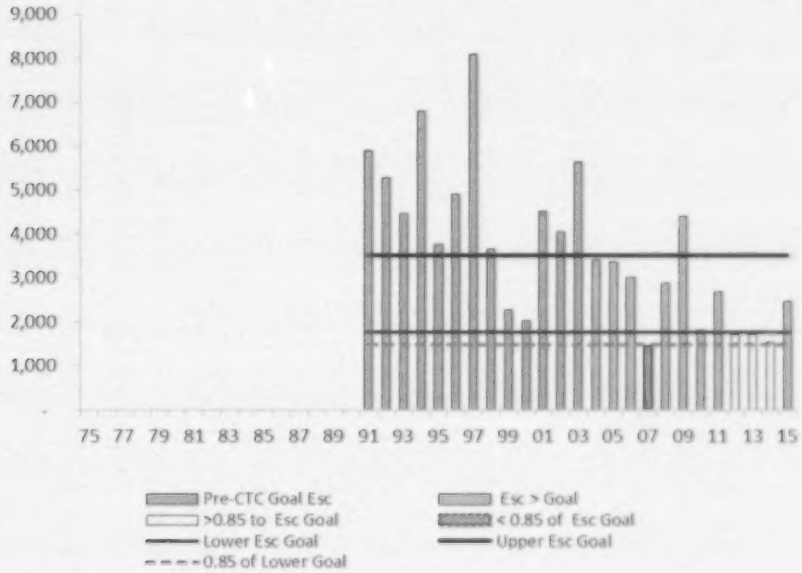


Figure 2.8.–Chilkat River escapements of Chinook salmon, 1991–2015.

2.3.1.3 Unuk River

The Unuk River is a moderate-sized glacial system that supports an inside-rearing stock of Chinook salmon. Escapement estimates are germane to large spawners as previously defined.

Harvests of immature and mature fish occur in SEAK and NBC fisheries. From 2005 to 2015, the harvest rate has averaged 38%, and by gear sector has been 26% SEAK troll, 6% SEAK sport, 5% SEAK net, and most of the remainder, 1%, caught in NBC, trawl surveys, private nonprofit hatchery, and terminal fisheries. Coded wire tagging of this stock was conducted for the 1982 to 1986 (Pahlke 1995) and 1992 to present broods; this stock is also an exploitation rate indicator stock.

Escapement Methodology: Escapements of large spawners are MR estimates of total escapement from 1997 to 2011, and expanded survey counts from 1977 to 1996 and 2012 to 2015. Radio telemetry studies in 1994 and 2007 showed that the surveys are conducted in stream reaches where 80% of the spawning occurs; the expansion factor for survey counts is 4.83 (Hendrich et al. 2008). Escapement assessments for Unuk River Chinook salmon consistently meet CTC data standards. Since 1997, CVs of estimates have averaged 11%; in those 19 years, 13 of the annual estimates had CVs of 15% or less. The six annual estimates with CVs exceeding 15% were from 2010 through 2015, where annual CVs averaged 17%.

Escapement Goal Basis: In 1994, ADF&G revised the Unuk escapement goal to 875 large spawners in survey (index) counts, based upon the spawner–recruit analysis reported by McPherson and Carlile (1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the goal to a range of 650–1,400 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the State of Alaska Policy for Statewide Escapement Goals. The CTC reviewed and accepted this change in 1998. Since the expansion factor for surveys was unknown at that time, the goal was expressed as an index peak survey count. In 2008, a more extensive analysis was done with spawners, recruitment, and fishing mortality expressed in total numbers of fish because of the extensive number of MR estimates of escapement and CWT data available (Hendrich et al. 2008). The analysis included the 1982–2001 brood years. The CTC-accepted a range of 1,800–3,800 large spawners, with a point estimate of 2,764 in 2009.

Escapement Evaluation: The Unuk River stock has historically demonstrated a healthy status with annual escapements from 1977 to 2011 within or above the escapement goal range in all years. However, productivity of the stock has declined in recent years and 2012–2014 escapements have been below goal. The 2015 escapement estimate is 2,623 large Chinook salmon (CV = 16%) which is within the goal range and close to the point goal of 2,764 large Chinook salmon (Figure 2.9).

Agency Comments: The large reduction in run strength of the Unuk stock in 2012, 2013, and 2014 was unexpected given its past history of consistent production. There are no directed fisheries that target this stock; sport fishing in freshwater is closed, marine sport fishing in East Behm Canal is closed during the spring and summer, and commercial fishing in nearby marine waters is closed. Additional management measures to reduce exploitation of this stock in the SEAK fishery were implemented in 2014–2015 which included closure of the sport fishery north of Ketchikan and closure of spring troll fisheries near Ketchikan. These management measures will continue in 2016.

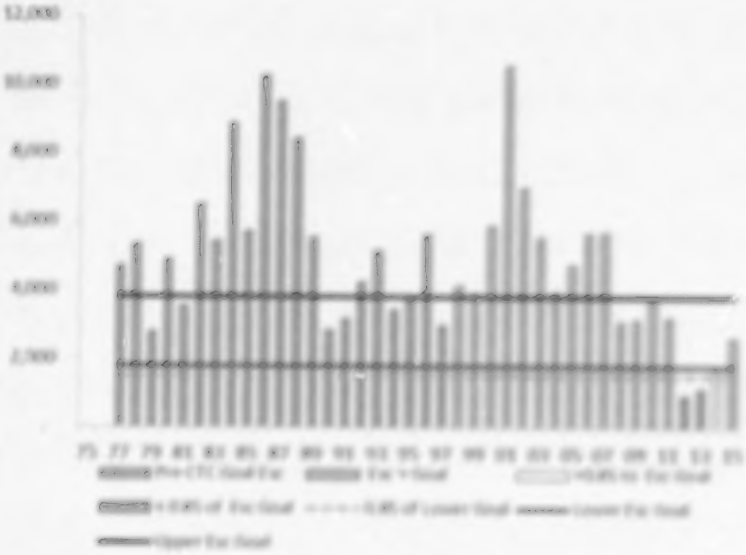


Figure 2.9.–Unuk River escapements of Chinook salmon, 1977–2015.

2.3.1.4 Chickamin River

The Chickamin River is a moderate-sized glacial system that supports a run of inside-rearing Chinook salmon, based on CWT recoveries. There is no terminal fishery targeting this stock; harvests of immature and mature fish occur in marine SEAK and NBC fisheries, with the majority of harvests taken in the southern inside quadrant of SEAK by troll and sport gear sectors. There are no subsistence or freshwater fisheries on any of the Behm Canal Chinook salmon stocks. Coded wire tagging on the Chickamin River was conducted for the 1982 to 1986 broods (Pahlke 1995) and resumed for the 2000 to 2006 broods.

Escapement Methodology: Escapements consist of MR estimates of large fish in 1995, 1996, and 2001 to 2005 and expanded survey counts in eight tributaries of the Chickamin River using standardized methodology (Pahlke 2003) from 1975 to 1994, 1997 to 2000, and 2006 to 2015.

Comparison of MR and survey counts found that about 21% of the total escapement is counted during peak surveys on average (Weller et al. 2007). A radio telemetry study in 1996 indicated that the annual surveys are conducted in stream reaches where over 80% of all spawning occurs. The expansion factor is estimated at 4.75 for survey counts using the results from the 1995, 1996, and 2001 to 2005 studies, and these assessments meet both US and bilateral CTC data standards.

Escapement Goal Basis: In 1994 ADF&G revised the goal to an index count of 525, which expands to an escapement goal range of 2,150 to 4,300 large spawners as recommended in the McPherson and Carlile (1997) report. The index count and escapement goal were reviewed and accepted by the CTC in 1998.

Escapement Evaluation: The Chickamin River stock is reasonably healthy while showing a cyclic

pattern of escapement since 1975. Annual escapements less than 25% of the goal have occurred eight times since 1975, all of which occurred before 1998. The 2015 escapement index was 567 large spawning Chinook salmon, which expands to 2,693 fish (CV = 15%) and is within the escapement goal range (Figure 2.10).

Agency Comments: The Chickamin River produces the largest bodied Chinook salmon of the four SEAK escapement indicator stocks. The time series of survey counts follows two cycles: counts from 1975 to 1981 and 1992 to 1998 were below the goal range, and those from 1982 to 1991 and 1999 to 2011 were all within or slightly above the range. The 2013–2015 escapements for this stock were slightly higher than the recent low point observed in 2012. Overall, the Chickamin stock has shown different escapement patterns than the majority of SEAK Chinook salmon stocks.

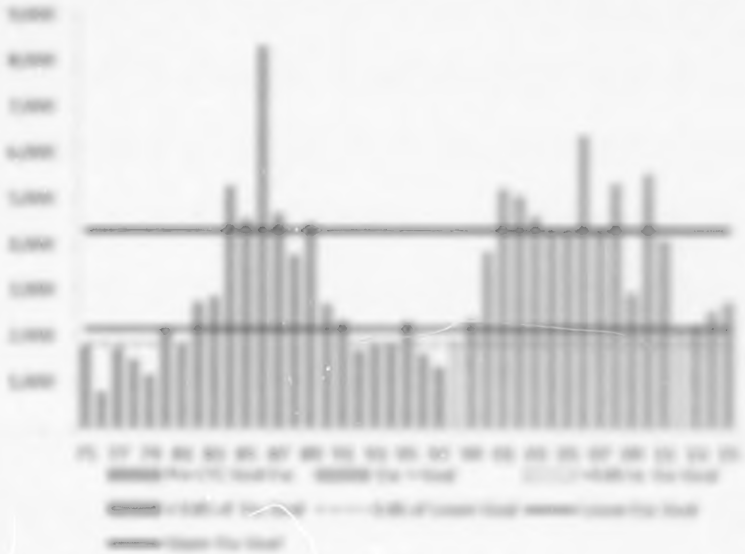


Figure 2.10.–Chickamin River peak index counts of Chinook salmon, 1975–2015.

2.3.2 Transboundary River Stocks

The TSR stocks include Chinook salmon returning to the Alsek, Taku, and Stikine rivers. Escapement estimates in the Taku and Stikine rivers are germane to large fish, defined as Chinook salmon equal to or greater than 660 mm length mid eye to tail fork. Escapement estimates include ocean-age-3, -4, and -5 fish, which contain almost 100% of the females in the population. Survey methods have been standardized since 1975 in the Taku River, and since 1975 in the Alsek and Stikine rivers. Biological escapement goals are in place for each of these stocks which consist of point estimates of S_{MSY} and escapement goal ranges.

All three TSR stocks can be classified as outside rearing based on ocean rearing distributions. These fish have limited marine rearing time in SEAK and are harvested primarily during their spawning migrations each spring. These fish are also mostly yearling smolt and return as ocean-age-1 through ocean-age-5 adults.

In response to low abundance, a 15-year rebuilding program was established by the ADF&G in 1981 (ADF&G, 1981). At the same time, ADF&G established interim escapement goals for all three systems, based on the highest observed escapement count prior to 1980. ADF&G and DFO have subsequently revised escapement goals for all three TSR stocks which have been reviewed and accepted by the CTC, Canadian Centre for Science Advice Pacific, and the TSR Panel. ADF&G uses escapement goal ranges for management, as promulgated under the State of Alaska Policy for Statewide Salmon Escapement Goals and Policy for the Management of Sustainable Salmon Fisheries.

2.3.2.1 Alsek River

The Alsek River is a large glacial system that originates in Canada in the SW Yukon Territory and NW British Columbia, and flows into the Gulf of Alaska about 50 miles east of Yakutat, Alaska. This river supports a run of outside rearing Chinook salmon.

Escapement Methodology: Since 1976, escapements have been monitored by a weir operated in Canada on the Blanchard River, which is one of 11 tributaries of the Tatshenshini River, the principal salmon-producing branch of the Alsek River. At the Blanchard River weir, escapement estimates, germane to Chinook salmon age 1.2 and older, have been based on counts of returning Chinook from 1976 to 1997. Alsek Riverwide escapement estimates were produced from 1998 to 2004 using direct MR. The average expansion factor used to convert Blanchard River weir counts into Alsek Riverwide estimates of escapement is 6.39. The MR estimates were cooperative stock assessment efforts among the Champagne Aishihik First Nations, DFO, and ADF&G. The 1976-1997 and 2005 to present Blanchard River weir counts have been expanded to represent Alsek River drainagewide escapement, based on the 6.39 expansion factor. Alsek Chinook salmon escapement assessments fail to meet bilateral CTC data standards due to CVs ranging from 29% to 63%.

Escapement Goal Basis: A revised goal of 3,300 to 5,300 total spawners (fish age 1.2 and older) was accepted by the CTC, ADF&G, and Canadian Science Advisory Pacific, based on analysis in Bernard and Jones (2010). Prior to this, the goal was based on escapement counts at the Blanchard River weir (McPherson et al. 1998).

Escapement Evaluation: Annual escapements of less than 65% of the goal have been observed four times since 1976, and all have occurred in recent years. These poor escapements appear to be the result of reduced productivity that has occurred in most of the last decade. Calendar year exploitation rates averted on the stock have averaged 10% since 1999. If no harvest had occurred in 2006, 2007, 2008, and 2012, the stock would still have failed to achieve the lower bound of the escapement goal range. The 2013 escapement was estimated at 5,897 (CV = 0.05) large Chinook, which exceeded the upper bound of the escapement goal range (Figure 2.11).

Agency Comments: Directed sport and Aboriginal fisheries occur in Canada in various upriver sections of the Alsek River. Some Chinook salmon are caught incidentally in the US sockeye directed fishery that takes place inriver near the estuary and within the estuary. A few Chinook salmon are also caught in a US subsistence fishery that takes place in the same area as the US sockeye fishery. Annual harvest rates have averaged only 7% from 1976 through 2010 using methods described in Bernard and Jones (2010).

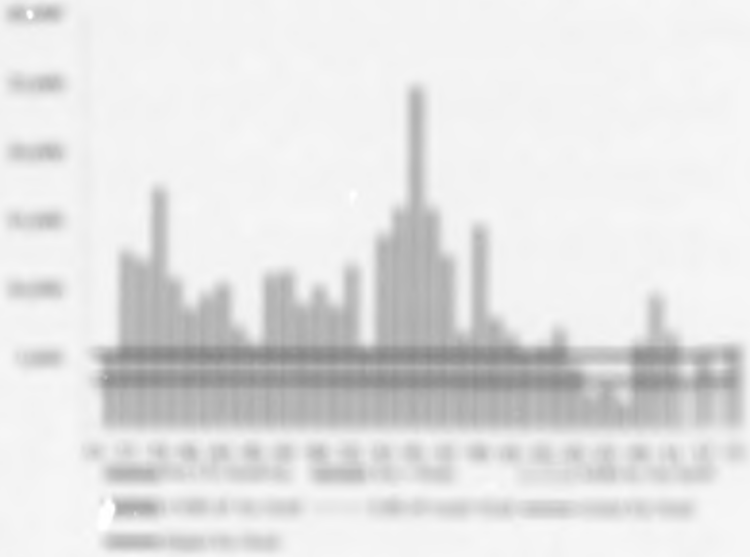


Figure 2.11. Black River escapements of Chinook salmon, 1978–2022.

2.3.2.2 Taku River

The Taku River is a large Transboundary glacial system that supports a run of outside-spring Chinook salmon. Taku River origin Chinook salmon are genetically sought in SEAK PF fisheries, but most catch occurs in terminal areas including District 111 of Southeast Alaska and in the Canadian portion of the lower Taku River. Directed gillnet fisheries take place in US and Canadian terminal areas often forecasted abundance or inseason assessments exceed predetermined levels as described in the Agreement under Chapter Five, Transboundary Rivers 2002(3). In other years, Taku River origin Chinook are also incidentally harvested in various directed gillnet fisheries in terminal waters (District 111 of Southeast Alaska and minor in Canada), in sport fisheries near Juneau, Alaska, and in minor First Nation fisheries in Canada.

Escapement Methodology. Escapement estimates of large Chinook have been generated through MR experiments in 1989, 1990, 1991–1997, 1998–2012, and 2013–2019. The MR estimates are from cooperative stock assessment efforts among the Taku River Tlingit First Nations, DFO, and ADFG. Taku Chinook MR escapement assessments are unbiased and have an average CV of 10%. Annual estimates since 1989 have CVs that range from 8% to 18% with 75% of the annual estimates meeting bilateral CV standards. ADFG has conducted standardized aerial survey counts annually since 1975. Counts prior to 1989, 1991–1995, 1996, and 2013 were expanded by a factor of 1.1, which is the average of the ratio of the MR estimates to aerial survey counts. Escapement estimates based upon expanded aerial survey counts are assumed unbiased and have a CV of about 30%.

Escapement Goal Basis. Prior to 1996, several systematic or index goals were developed by the US and Canada based upon limited data. A goal based upon maximizing stock production was in place from 1989 to 2008 McPherson et al. 2009. In 2008, an escapement goal of 40,000

to Fitzville Image Network patrons, based upon stroke record analysis (Mirfitzpatrick et al., 2003), was recreated by Rau (11).

Environmental Risk Factors Rau Tobin Whole Health is reasonably healthy with annual compliance of less than 10% of the upper percentage area image areas (MPI 0.0276), (MB), (MPI). Rau stroke compliance estimate is 38.0% (CI: 0.0% image Network patrons, which suggests Rau heart disease of Rau compliance upper image and is about 0.4 Rau Δ_{c} upper upper of Fitzville (Figure 5.1.2).

Clinical Comments Tobin Whole Network patrons are North as compliance and as compliance and as compliance and indicators stroke. Since 2003, coverage years of underserved Underserved Network patrons Fitzville have been between stroke on Tobin Whole Network have stayed Rau 0.0% to 0.0%, increasing 0.0% over 2003-2003, upwards point compliance to reach stroke with MPI 0.0 stroke to compliance stroke effectiveness and stroke productivity, as well as to estimate Network to remain stroke Fitzville and underserved stroke. While stroke have been reached with MPI 0.0276 (MB) and 0.0% compared under accounting to Fitzville and as Rau upstanding stroke was used to estimate underserved stroke productivity. Relatively, a significant decrease marine upward Fitzville accounts has stroke environment was not adequate for management. In 2003, Rau Rau developed an educational Health management regime for Tobin Whole stroke Network with focuses coverage of compliance upwards Rau to Fitzville (1.0 Fitzville 0). Rau regime includes a Fitzville, increase the progressive, and a Fitzville compliance stroke. Other coupled with stroke coverage of Fitzville Fitzville as North stroke of Rau Number. Rau affected underserved Network patrons stroke coverage compliance stroke and stroke. Rau Tobin Whole stroke has shown decreasing productivity over Rau past five years. Rau stroke appears to be adequate marine accounts. Until Fitzville conditions improve, it is unlikely that Underserved Fitzville will Rau accounts stroke and underserved Fitzville marine stroke will be increased.

Figure 5.1.2: Tobin Whole compliance of Network patrons, (2003-2003)

5.5.5.1.1 Ultima Ratio

The Ultima Ratio is the staple of Southland Marine, originally a Western, Wyoming, and Texas rifle. It is based on a modified Southland Marine base rifle known as the Ultima Ratio and Ultima Ratio Carbine. The standard rearmament kit is a Ultima Ratio Primary, which includes a Carbine and Ultima Ratio Carbine, and a Ultima Ratio Carbine. The Ultima Ratio is a modified version of the Ultima Ratio Carbine, and the Ultima Ratio Carbine is a modified version of the Ultima Ratio

mainstem of the Nass River is extremely turbid with visibility near zero for most of the year. Among the major Chinook salmon producing tributaries, the Bell Irving River is glacially turbid while the Meziadin, Cranberry/Kitsen, Kwinageese and Damdochax rivers are relatively clear. Nass River Chinook salmon are primarily stream-type salmon and are thought to be far north migrating.

Escapement Methodology: Prior to 1992, DFO observations of Nass River Chinook salmon escapement were based on visual counts. Programs using MR have been conducted since 1992 by the Nisga'a Fisheries to estimate total spawning escapement in the Nass River. The Nass MR program uses two fish wheels at GW in the Lower Nass canyon and occasionally two wheels at Grease Harbor further upstream to apply tags. The Meziadin River fishway, a weir on the Kwinageese River, and a dentipitch program on the Damdochax River are used for tag recovery. Tags were also recovered in upriver fisheries and on the spawning grounds. A modified Petersen model was used to estimate the total population of Chinook salmon past the tagging location. Spawning escapements were calculated as the estimated population past GW from the MR studies, minus upriver catches in sport and First Nations fisheries. Three tributaries with Chinook populations—the Kincolith, Ishkeenickh and the Iknouk—enter the Nass River below GW. Visual estimates of these systems were augmented by fence counts of the Kincolith River in 2001, 2002, 2005, and 2007 to estimate escapements below the fish wheels.

Escapement Goal Basis: There is no CTC-accepted escapement goal for this stock. The Fisheries Operational Guidelines define two goals for managing Chinook salmon fisheries: an operational escapement target of 20,000 fish, and a minimum escapement target of 10,000 fish. If escapements are projected to be below 10,000 fish, then no fishing on Nass River Chinook salmon would be recommended. The median estimate of S_{MSY} for the Nass River upstream of GW using the habitat model was 16,422 (CV = 23%) Chinook salmon based on a watershed area of 15,244 km^2 (Parken et al. 2006; Figure 2.14).

Agency Comments: Chinook salmon escapement estimates produced before 1992 have been calibrated to the MR estimates. The Nisga'a Fisheries Working group, including DFO, has accepted the historical escapement and terminal run values. The Sentinel Stocks Program (SSP) funded a project on the Kwinageese River and Damdochax Creek designed to increase recoveries and improve the escapement estimates for the Nass Chinook aggregate.

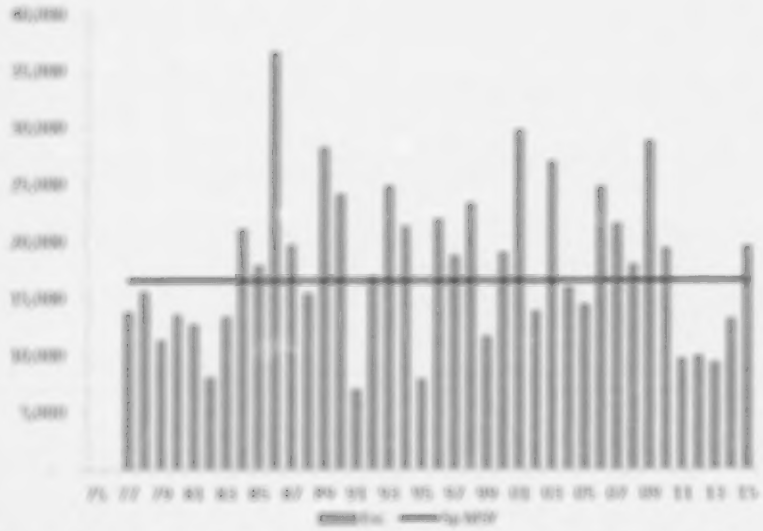


Figure 2.14.–Nass River escapements of Chinook salmon, 1977–2015.

2.3.3.1.3 Skeena River

The Skeena River is the second largest river in British Columbia and drains an area of approximately 54,400 km^2. It supports the second largest aggregate of Chinook salmon stocks in British Columbia with over 75 separate spawning populations. Four large lake-stabilized tributaries, the Kitsumkalum, Morice, Babine and Bear rivers, account for 65% of the total Chinook salmon abundance in the Skeena River. The Kitsumkalum River is glacially turbid and visual methods for enumerating salmon are not appropriate. By comparison, other major Chinook salmon-producing tributaries like the Morice, Bear, Babine, and Kispiox rivers run relatively clear, especially in late summer when most of the Chinook salmon spawning occurs. Skeena River Chinook salmon are primarily stream-type salmon (approximately 97%), and are far north migrating. Most of the Skeena River Chinook salmon populations are summer run, but spring run fish occur in the Cedar River and the Upper Bulkley River.

Escapement Methodology: Historically, Chinook salmon escapements to the Skeena River have been represented by an index that includes approximately 40 populations surveyed annually using a variety of techniques (Figure 2.15; solid bars). Most of the escapement estimates are based on visual observations from helicopter, fixed wing aircraft and/or from stream walking surveys but fish counting weirs are present on the Babine, Sustut, and Kitwanga rivers. The Kitsumkalum River is the exploitation rate indicator stock for Northern British Columbia, and the spawning population has been estimated using a MR program since 1984. The Kitsumkalum represents approximately 30% of the spawners measured by the Skeena escapement index. The Bear and Morice river populations have contributed 20% (Bear) and 26% (Morice) to the escapement index since 1984. The visual estimates for these systems tend to underestimate their actual contribution to the total escapement in the Skeena aggregate.

Chinook salmon returns to the Skeena River have also been estimated using the proportion of Kitsumkalum River fish measured from genetic samples collected at the Tyee test fishery and

from Kitsumkalum Chinook escapement estimates from independent MR programs (Figure 2.15, checkered bars). Preliminary estimates are available from 1984 to 2014 as a result of SSP and Northern Fund projects. The genetic-based estimates represent an improvement over the historic indices because they include estimates of variance which cannot be produced for the historic indices. Also, comparisons between years are valid since the method is consistent across the time series, whereas methods used for the historic indices varied through time.

The genetic studies found that the Kitsumkalum River conservation unit contributes, on average, 18% to the Skeena River aggregate. The Morice, Bear, and Babine populations make up the Skeena Large Lake conservation unit and contribute 31% (Morice), 7.4% (Bear) and 6.6% (Babine) to the aggregate. An average contribution of 45% makes the Skeena Large Lake conservation unit the largest in the watershed.

Escapement Goal Basis: There is no CTC-accepted escapement goal for the Skeena River aggregate. The estimate of S_{MSY} for the Kitsumkalum indicator stock is 8,621 Chinook salmon based on stock–recruitment analyses (McNicol 1999; updated in Parken et al. 2006). Habitat-based estimates of S_{MSY} and other reference points are available for stocks within the Skeena River, but estimates of total escapement (or calibration of the visual indices) are needed to make them effective (Parken et al. 2006). Future assessments will partition this large aggregate into stocks by run timing, life history, and geographic areas.

Agency Comments: Terminal fisheries in the Skeena River normally include commercial gillnet in the terminal exclusion area (River Gap Slough, Area 4), inriver sport, and aboriginal fisheries. Estimates of inriver sport catch were not available from 1997 to 2002 but creel surveys were conducted on the Lower Skeena in 2003 and 2010–2015. Consequently, the total terminal run estimates in these years include lower-river sport catch but no estimate of upper-river sport catch. Spawning escapements to the Kitsumkalum River have exceeded the point estimate of S_{MSY} in every year since 1998 (Figure 2.16).

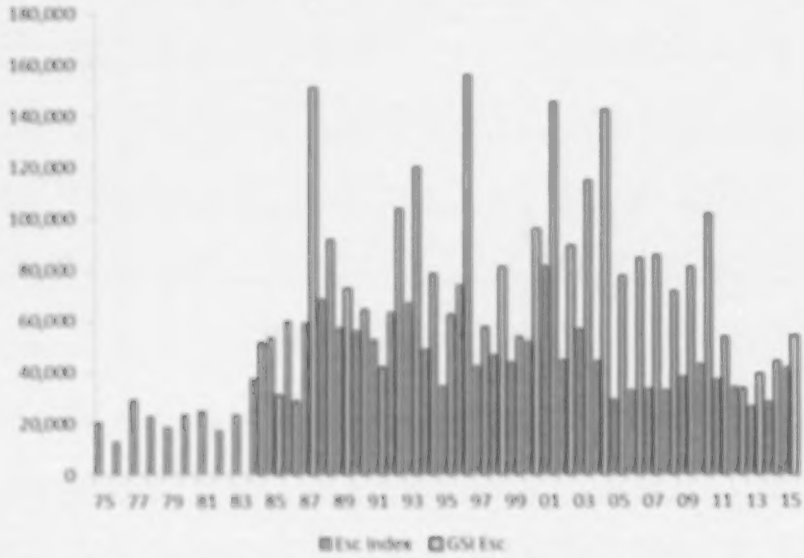


Figure 2.15.–Skeena River escapements of Chinook salmon, 1975–2015.

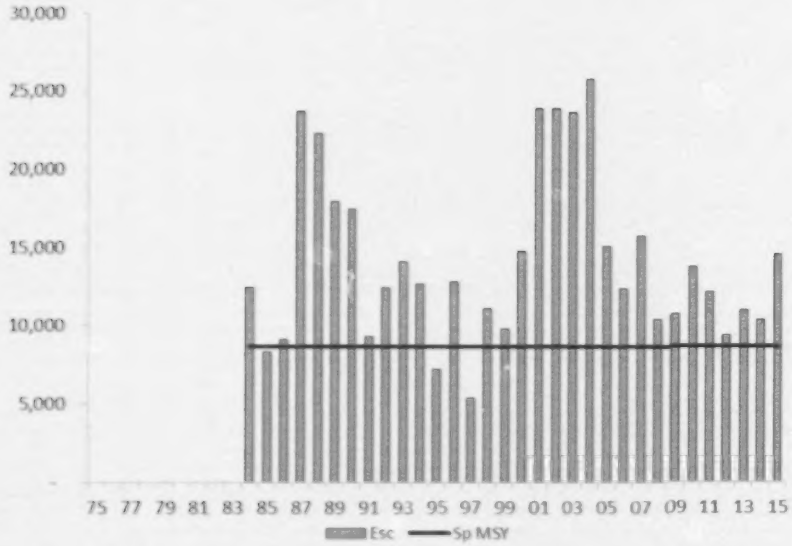


Figure 2.16.–Kitsumkalum River escapements of Chinook salmon, 1984–2015.

2.3.3.2 Central British Columbia

2.3.3.2.1 Dean River

Chinook salmon populations in Area 8 consist of seven nonenhanced systems, and the Bella Coola and Atnarko River system which is enhanced. Among nonenhanced systems, the Dean River, located along the central west coast of British Columbia, has the largest spawning population and the most consistent escapement surveys. The Dean River originates at Nimpo Lake approximately 150 km east of the community of Bella Coola and flows in a northwesterly direction for approximately 253 km before entering the Dean Channel. Chinook returning to the Dean River exhibit summer run timing and are predominantly stream type (94%).

Several tributaries provide salmon spawning habitat between Nimpo Lake and Dean Channel including the Takia River, Tahyesco River, and Sakumtha Creek. The upstream limit to the migration of spawning salmon is Salmon House Falls near the confluence of the Takia River and Dean River. Spawning Chinook have been observed in the Takia River near the lower Tanya Lake, in Tahyesco River as far as Compass Creek, and in Sakumtha Creek near Skuce Creek.

Between 2012 and 2014, the CTC was unable to assess stock performance because Dean River Chinook salmon escapements were not estimated due to insufficient resources. In 2015 funds were secured for aerial assessment. See Appendix Table B3 for escapements through 2015.

Escapement Methodology: Since 2001 the Chinook salmon escapement index for the Dean River has been derived using area-under-the-curve (AUC) methodology based on three aerial counts. In years where viewing conditions were poor, a maximum likelihood procedure has been used (e.g. 2004). A Chinook salmon MR program was conducted on the Dean River in 2006 to develop an expansion factor for converting the escapement indices into estimates of

total escapement. In 2015, the Chinook salmon escapement index of 2,470 for the Dean River was derived using the same AUC methodology employed from previous years.

Escapement Goal Basis: There is no CTC-accepted escapement goal for this stock. Biologically based goals for this complex of Chinook spawning populations have not yet been developed. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available (median S_{MSY} = 3,646, CV = 14%), but estimates of total escapement are needed to make them effective.

Agency Comments: Chinook escapement was not estimated between 2012 and 2014, and funding has not been secured for the 2016 season. Terminal fisheries in the Dean River included commercial and inriver sport fisheries. Inriver sport catch estimates from provincial creel surveys identified 29 Chinook harvested by anglers in 2015 and five Chinook harvested in commercial gillnet fisheries.

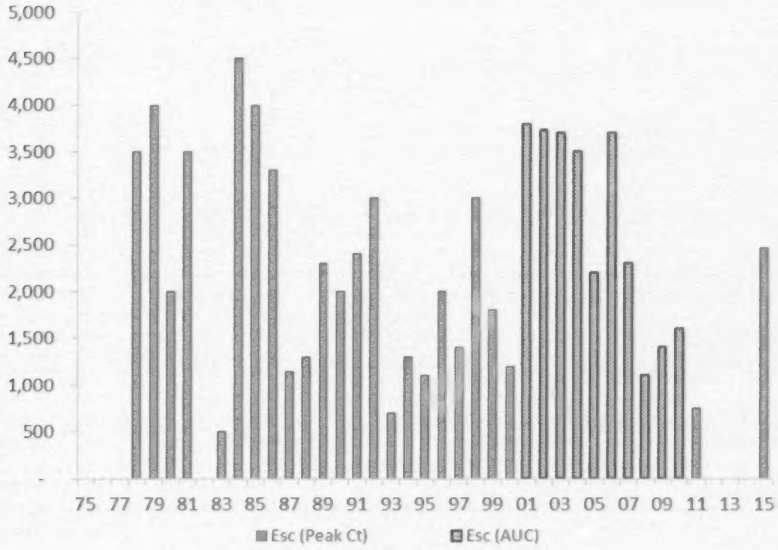


Figure 2.17.–Dean River escapements of Chinook salmon, 1978–2015.

2.3.3.2.2 Rivers Inlet

The Rivers Inlet escapement index consists of an aggregate of Chinook salmon escapements to the Wannock, Kilbella, and Chuckwalla rivers (Figure 2.18). The Wannock River drains Owikeno Lake into the head of Rivers Inlet. It is about 6 km long, over 100 m wide, and is glacially turbid. Wannock Chinook salmon are genetically distinct from other Chinook salmon populations in the central coast of British Columbia. This ocean-type stock exhibits fall run timing and is renowned for its large body size, due to ocean-age-4 and age-5 year components in the return. The Kilbella and Chuckwalla river systems share an estuary on the north shore of Rivers Inlet. These systems are relatively small and run clear, but the degree of turbidity is dependent upon precipitation. The Chinook salmon populations in the Chuckwalla and Kilbella rivers have summer run timing and are stream-type salmon. The largest contributor to the index is the

Wannock River, which represents an average of 76% of the production for this index over the past decade, and over 95% since 2010.

Escapement Methodology: Chinook salmon escapement estimates for the Wannock River are produced from an annual carcass recovery program. Estimates are derived by expanding the number of carcasses pitched based on historical recovery rate assumptions. Expansion factors are somewhat subjective and take into consideration water clarity, river height, and recovery effort. The visual index estimate for Wannock Chinook salmon in 2015 was 5,328 based on expansion of carcass recoveries during the traditional deadpitch program. Programs to calibrate carcass recoveries with population estimates from MR experiments were conducted from 1991 to 1994 and again in 2000. Results suggest the estimates based on the subjective expansions of carcass recoveries underestimate the Wannock Chinook salmon population by approximately half. Inherent bias as well as imprecision in the MR estimates leads to uncertainty in calibration of the carcass estimates.

Chinook salmon escapements for the Chuckwalla and Kilbella rivers are estimated using AUC methods applied to visual counts from helicopter surveys. Typically four flights are made during the spawning period. The estimates are preliminary and any revisions will be presented in next year's report. The 2015 estimated escapement to the Kilbella River was 300 and to Chuckwalla River was 274.

Escapement Goal Basis: There is no CTC-accepted escapement goal for these stocks. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available but estimates of total escapement are needed to make them effective. Habitat-based escapement goals were thought to overestimate S_{MSY} for the Wannock River because the stock may be limited by the relatively small amount of spawning area available (Parken et al. 2006).

Agency Comments: A small hatchery enhancement program occurs on the Wannock River but the contribution to the total population is unknown. Production from enhancement of the Kilbella and Chuckwalla rivers from 1990 to 1998 is thought to have had significant influence on escapements from 1994 to 2003, but estimates of the enhanced component are not available. However, estimated returns to the Kilbella and Chuckwalla rivers averaged 1300 Chinook salmon during the period of enhancement. Recent returns have averaged less than 500 Chinook salmon for both rivers combined; it is unclear if these populations have returned to pre-enhancement levels or are experiencing an unrelated decline.

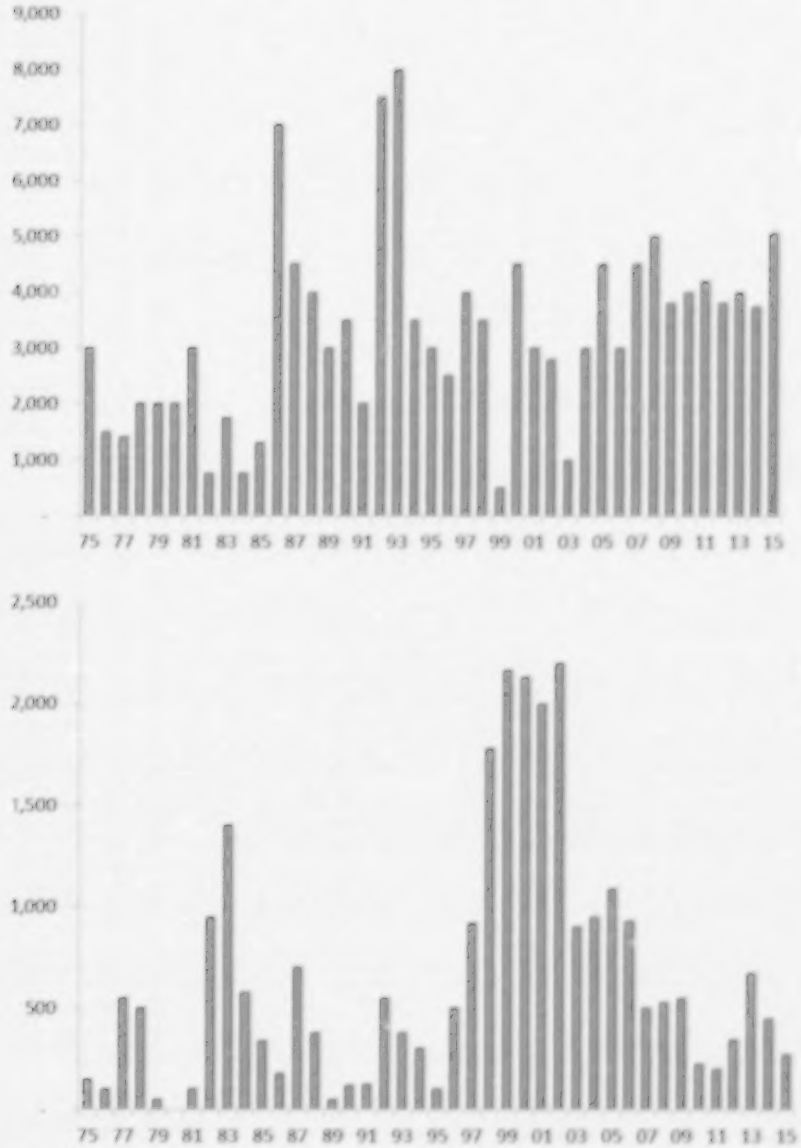


Figure 2.18.–Rivers Inlet escapement index of Chinook salmon, 1975–2015, including Wannock River (upper) and Kilbella and Chuckwalla rivers (lower).

2.3.3.2.3 Atnarko River

Following the 2009 PST Agreement, the CWT Improvement Program highlighted the lack of a Chinook salmon indicator in the Central British Columbia region. In order to convert the existing Atnarko Chinook Assessment program into an exploitation rate indicator, a series of objectives were identified including the application of 250,000 additional CWTs, sampling of the terminal commercial, sport, and First Nations fisheries, and reintroduction of a MR program to improve escapement estimates (Velez-Espino et al. 2011). Implementation of these changes began in 2009 (Velez-Espino et al. 2010) and subsequent MR programs have yielded escapement estimates with corresponding CVs of less than 15% for all years (Velez-Espino et al. 2014).

The Northern/Central CTC model stock group is represented by Kitsumkalum River which is a stream-type stock, while the Atnarko River, which feeds the Bella Coola River and is situated in Statistical Area 8 on the Central Coast of British Columbia, is predominantly an ocean-type stock. It constitutes the largest complex of Chinook salmon in Central British Columbia. Hatchery releases of Atnarko Chinook salmon have averaged around 2 million annually with recent CWT releases in excess of 400,000. Atnarko CWT recoveries occur in both US and Canadian AABM fisheries as well as coastal British Columbia ISBM fisheries.

Escapement Methodology: Three methods have been used since 1990 to generate independent estimates of Chinook salmon escapement in the Atnarko River. These methods are based on (1) catch per unit effort (CPUE) during broodstock collection, (2) carcass counts during dead pitching, and (3) the number of spawners observed during drift boat surveys. The simplicity and low cost of these three methods has allowed the continuous monitoring of Atnarko escapement, and the average of these three population estimates (3MA method) has been used as escapement estimate in years without MR studies. A serious flood event in the fall of 2010 impacted the Atnarko by altering flow dynamics and creating a sequence of obstructive log jams. As a result, the use of rafts to obtain drift counts was no longer feasible. Robust maximum likelihood estimates within a model selection framework have been developed for escapement of total and wild Atnarko Chinook salmon, based on MR data for years 2001–2003 and 2009–2013. The 1990–2013 time series of Atnarko Chinook salmon escapement was calibrated using Generalized Linear Models based on these high-quality escapement estimates and data routinely collected for the 3MA method (Vélez-Espino et al. 2014). The estimation model used for time series calibration also serves as a tool to generate reliable escapement estimates based on broodstock CPUE and carcass counts. The calibrated escapement estimates have yielded escapement estimates with corresponding CVs of less than 15% for all years, except 1995 (17.9%) and 2006 (15.6%; Velez-Espino et al. 2014).

Escapement Goal Basis: There is no CTC-accepted escapement goal for Atnarko Chinook salmon. A habitat-based escapement goal (Parken et al. 2006) of 5,009 wild fish has been developed for Atnarko Chinook salmon (Vélez-Espino et al. 2014). This habitat-based escapement goal represents a first iteration in the process of refinement required to quantify the spawning escapement at maximum sustainable yield (S_{MSY}) for this stock (Figure 2.19).

Agency Comments: The Atnarko River has been developed as an exploitation rate indicator stock (Velez-Espino et al. 2011). MR estimates with corresponding CVs less than 15% have been attained in 10 program years (2001–2003 and 2009–2015). The estimation model used for the

1990–2013 time series calibration can also generate reliable escapement estimates based on broodstock CPUE and carcass counts. Carcass counts, used with a calibrated time series of escapement, provide a method to produce escapement estimates in the future when MR data is absent. Future calibrations would be required for years without MR data and will include new data derived from subsequent MR studies. This was not necessary for 2013, because MR studies took place for Atnarko Chinook.

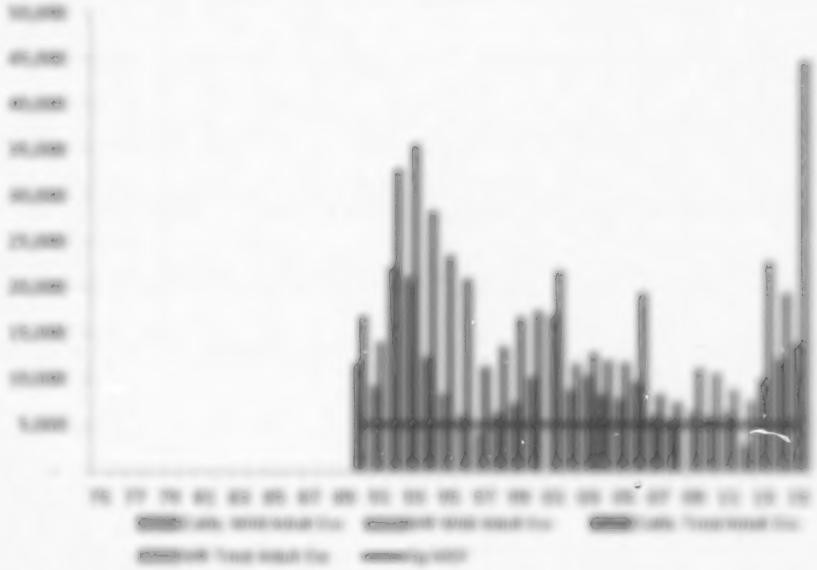


Figure 2.19 –Atnarko River escapements of wild adult (excluding jacks) and total adult (hatchery and wild, excluding jacks) Chinook salmon, 1990–2013.

Note: Estimates for 2001–2003 and 2009–2013 are based on mark-recapture data. Estimates for all remaining years are based on time series calibration via Generalized Linear Models parameterized with MR data, carcass counts and broodstock CPUE (Miller-Espino et al. 2014).

2.3.3.3 West Coast Vancouver Island and Georgia Strait

2.3.3.3.1 West Coast Vancouver Island

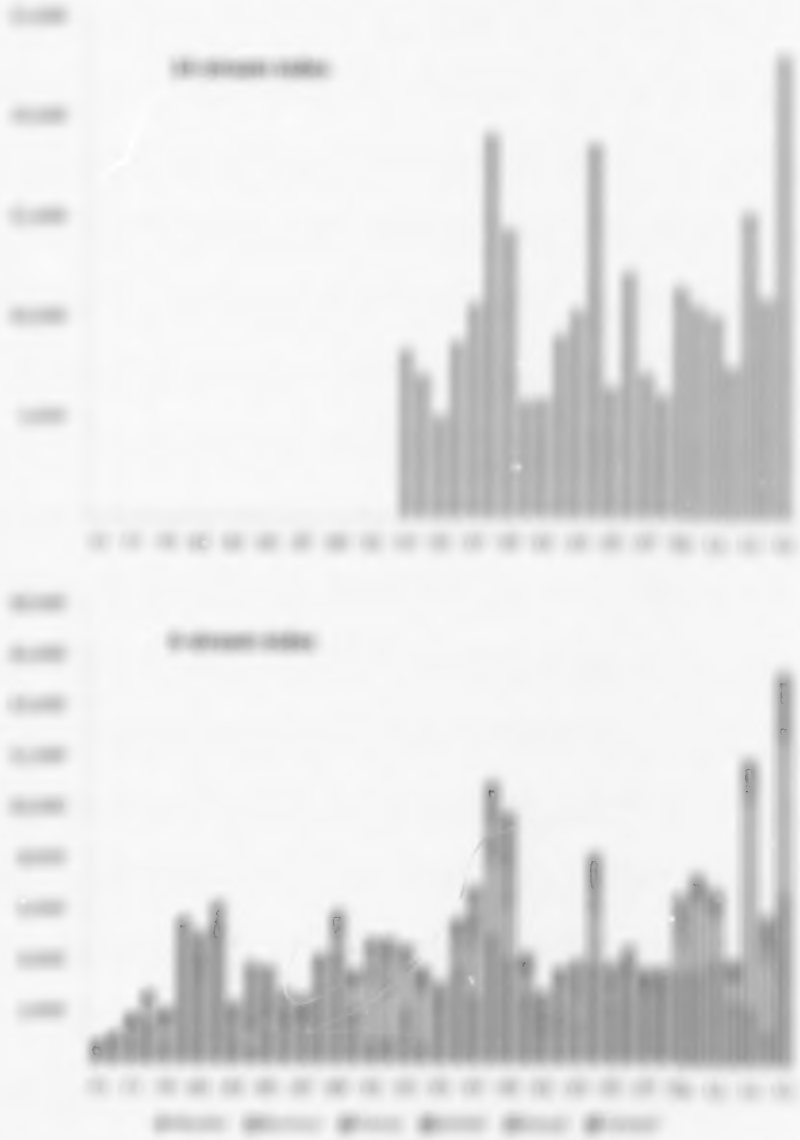
Escapement Methodology: The WCVI index represents the sum of escapements for six rivers (Marble, Tahsis, Burman, Artlish, Kaouk, and Tahsish), which were chosen to provide an index of escapement for wild WCVI stocks in general. These stocks were chosen based on historical consistency of data quality, although the escapement methodology changed in 1995 and prior estimates have not been calibrated to the new methodology. DFO also developed a 14-stream expanded index which includes escapements to the 6-stream index plus the following WCVI streams: Colonial and Cayeqla (Area 26); Leiner (Area 25); Megin, Bedwell/Ursus, Moyeha (Area 24); Sarita, Nahmint (Area 23); and San Juan (Area 21). In 2005, the Colonial/Cayeqla escapement estimate was not available, and was therefore not included in the 14-stream index (Figure 2.20). From 2007 through 2013, a MR program was conducted on the Burman River in

addition to the regular swim and foot surveys (Figure 2.23). The Duncan River escapement estimate used for the 8-stream and 14-stream indices, however, is the swim and foot survey results instead of the MR estimates. The escapement indices in 2010 were 15,249 Chinook salmon for the 8-stream index and 23,063 for the 14-stream index (Appendix B5).

Over the last decade, the PSC Sentinel Stocks and Endowment Fund programs have conducted several studies aimed at producing high-quality escapement estimates that are consistent with the CTC data quality standards (CTC 2010). In 2013 and again in 2014, Canadian Science Advisory Process workshops were held with the objective of evaluating the escapement estimation methodology used to assess the abundance of WCVI indicator stocks. The reviews produced several recommendations for further work and potential improvements. It is anticipated that this work may eventually result in revised escapement data, with measures of precision, which are better quality than the estimates presented in Figure 2.28.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for these stocks (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Escapements have remained low in nonenhanced streams since 1999 despite terminal fishing restrictions in effect in Areas 24-28 from July to September each year. Escapement indices to all nonenhanced Clayoquot Sound and Nootka Sound Chinook salmon streams remain below 500 fish.



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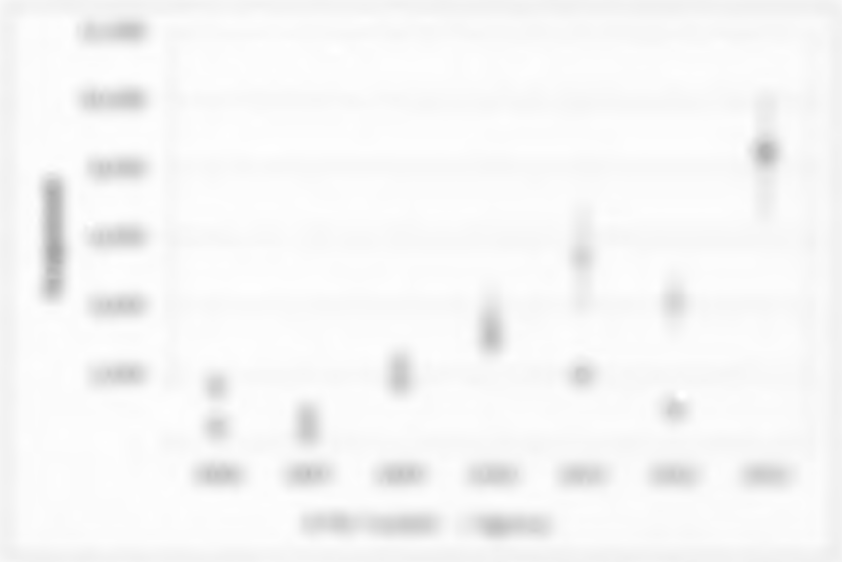

Figure 4.2.6 – Maximum Rhizal micropropagation of [illegible] cultivars in a pure culture medium supplemented with various concentrations of [illegible] medium. Lower case letters above each column indicate results of multiple comparisons between treatments. Error bars represent standard deviation. Data from Jay [illegible]

5.10.10.10.10 Japanese Wonder of Mazzanjan

The Japanese Wonder of Mazzanjan (JWM) clonal rootstock consists of Prunus mume (Mirabelle), Hybrid Mirabelle, Mirabelle, Dragonmoss, Mirabelle(M). Prunus mume plant is commonly found in Japan and the Mirabelle Prunus is an northeast Mediterranean rootstock.

Management Distributions: The accuracy of management estimates in this mainland clonal rootstock is poor. Most likely due to the variability in Englewood systems, remote nursery, and shortage of surveys. Furthermore, management estimates have commonly been based on varied sources, weighting other advisor opinions, which may not coincide with the most supporting around the Chinese advisor. North Carolina and Western states have been contributed to the Mirabelle Prunus, and to the United Kingdom concentration on the Mirabelle Prunus Prunus cultivar. The management time series for this JWM clonal rootstock estimates based on consistent methods, nothing exact nor, and management is a mixture including management data the nursery stock [illegible]. An conversion table estimated using the procedures described by Chagnon et al. (2003). The estimated management for this JWM clonal group in 2010 was 10,000 Chagnon/ha / hectare (Figure 4.2.6).

Management Goal Gaps: There is currently no FTE recorded management goal for this clonal group.

Agency Comments: Assessment of clonal status is highly uncertain and the management time series requires reconsideration to realistic represent the clonal group in the PNW. Unknown causes differences in current clonal fluctuations, cut-backing, and the history indicates that future assessments should separate this clonal group into consideration series.

Figure 11.21 – 17 years old, high-Medi-Medi medical group management of Kimmel cohort, 2010–2020

Note: Top panel shows 17-year-old high-Medi-Medi medical group management of the Kimmel cohort, by year of entry. Bars are stacked by primary diagnosis cluster. Bottom panel shows mean monthly cost by cluster, in thousand dollars, for the same cohort.

11.21.1 Lower Mode of Entry

The lower Mode of Entry is dominated by cases classified in the cohort with presenting MH Kimmel without primary management code. Most hospitalizations could alternatively enter. Figure 11.21 and Figure 11.22.

Management Modification. Kimmel Kimmel without primary diagnosis management cases, 2010–2014. Since 2015, management contributes. Since then hospitalizations. Mean cases decreased from a peak, and decline continues. The proportion of cases which could the Alternative Mode prior to 2015 – about 1,800 – dropped to consistently fewer than 500 cases prior to the Alternative Mode. Moreover, 1,800 cases 1,800, and only 400 cases were used in the Alternative Mode. Cases since 2015, 400 cases and than cases. Cases in the Alternative Mode. Average Mode in Kimmel in a staggering total in 2009. The proportion management in 2010 was 1,800 Kimmel without primary MH. Mean hospitalizations Mode and 1,800 MH. Mean Alternative Mode.

Management Total Costs. Of management spent $10,000,000 in 2010, 2015, Mean hospitalizations Mode cases management Mode MH in 2009 Hospitalizations in 2009. Patients in Kimmel in 2010 Management management spent MH. Mean Alternative Mode. Hospitalizations Mode in 2010 Alternative Mode hospitalized MH. Total of 10,000 Alternative Hospitalizations. In 2010, Mean Mode in 2009.

Agency Commonality. The Hospitalizations Mode cases Kimmel in consider public hospitals in management in 2009 cases 2009. Kimmel MH in a health planning in management cases. Mean Mode of cases Mode 2009 Kimmel MH management spent. Agency Mode Kimmel Alternative Mode in management cases Mode cases. Cases in Mode in Alternative Mode in in Mode cases. Mode MH Mode Mode in Kimmel.

2.3.3.4 Fraser River Stocks

A large and diverse group of Chinook salmon spawning in Canada occurs in the Fraser River watershed, with many local populations (CTC 2002b; Candy et al. 2002).

Much of the knowledge about the status of Fraser Chinook salmon is based on spawner escapement data. Most data are from visual surveys, which are generally biased low, although many estimates are considered to be precise (Parken et al. 2003). Visual survey data are generated from aerial surveys and the escapement estimate is usually obtained by dividing the peak count by 0.65 (Farwell et al. 1999; Bailey et al. 2000). The DFO continues to evaluate the accuracy of the peak count method through calibration studies, such as those funded by the PSC Sentinel Stocks and Endowment Fund programs. Escapement has been estimated at several locations using MR methods and direct counts at fishways or resistivity counters.

Currently, Fraser River Chinook are assessed as five stock groups for PSC management: (Fraser spring run 1.2, Fraser spring run 1.3, Fraser summer run 1.3, Fraser summer run 0.3, and Fraser Late); however, Fraser River Chinook are only represented by two stocks in the CTC model (Fraser Early and Fraser Late). As part of the CTC Model Improvements program, the Fraser Early model stock is being separated into four model stocks to better represent population dynamics.

Within the Fraser River, there are five current CWT indicator stocks: Nicola River (Fraser spring run 1.2), Lower Shuswap (Fraser summer run 0.3), Middle Shuswap (Fraser summer run 0.3), and Harrison River and Chilliwack River for Fraser Late. The Dome Creek CWT indicator stock (Fraser spring run 1.3) was discontinued in 2005.

Only the Harrison River has a CTC-approved escapement goal. For the remaining four stock groups, habitat-based models have been developed to estimate spawning capacity and spawner abundance producing maximum sustained yield (Parken et al. 2006). In 2014, a Canadian Centre for Science Advice Pacific meeting examined the status and benchmarks for Southern British Columbia Chinook conservation units, including Fraser. Benchmarks and status were accepted for unenhanced conservation units, but further work on enhanced Conservation units was necessary to evaluate status.

Escapements to the three stock groups with yearling smolt life history declined steeply from 2003 to 2009, and yearling smolts that entered the ocean in 2005 and 2007 had low survival. Recently, escapements have been low but with modest rebuilding over brood years. In contrast, escapements to the Fraser summer run 0.3 increased during the 1990s and remained abundant until 2012, which was very low compared to levels over the previous decade. Since 2012, escapements have increased from 2013 to 2015.

For the Fraser late stock group, the Harrison River had very low escapements from 2012 to 2014 with escapements more than 15% below the lower bound of the escapement goal. Escapement was estimated at 101,516 in 2015, which is higher than the 2014 escapement and just above the upper escapement goal. However, the escapement was only 82% of the 2011 parental brood of 123,478.

2.3.3.4.1 Fraser River Spring Run: Age 1.3

The Fraser River spring run age-1.3 aggregate includes the Upper Pitt and Birkenhead river stocks in the Lower Fraser; the spring run stocks of the Mid- and Upper Fraser, North Thompson, and South Thompson; but excludes those of the Lower Thompson tributaries (CTC 2002b).

Escapements are mostly estimated by expanded peak counts of spawners, holders, and carcasses surveyed from helicopters or on foot. Escapements decreased in 2015 from levels observed in 2014; however, the escapement exceeded the parental brood escapement levels in 2010. Escapement was estimated at 23,505 in 2015 (Figure 2.25).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this aggregate. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and electronic resistivity counter methods.

Agency Comments: The stock group has declined substantially over the last decade and is a stock of conservation concern.

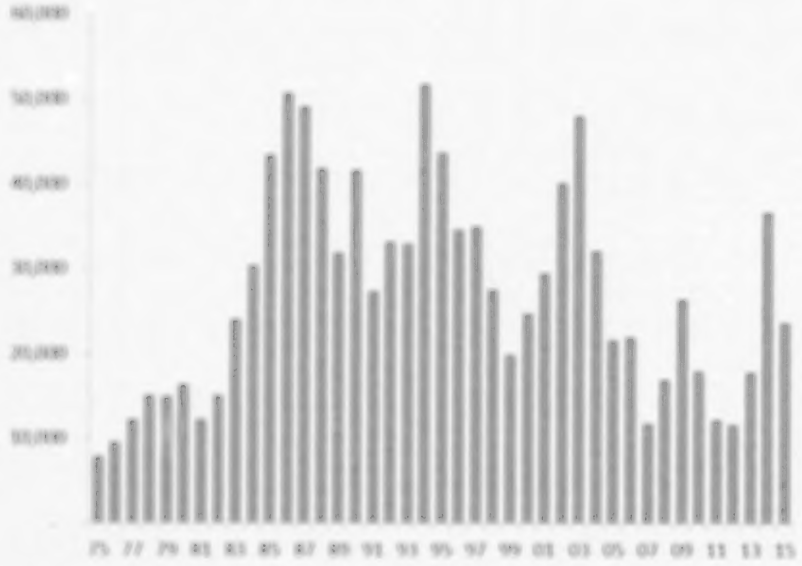

Figure 2.25.–Fraser River spring run age-1.3 stock group escapements of Chinook salmon, 1975–2015.

2.3.3.4.2 Fraser River Spring Run: Age 1.2

The Fraser River spring run age-1.2 aggregate includes six populations that spawn in the Lower Thompson River tributaries and Louis Creek of the North Thompson, and the spring-run fish of Bessette Creek in the South Thompson (CTC 2002b). This stock group has an early maturation schedule for a stream-type life history, with an average generation time of 4.1 years (brood

years 1985–1986), which results in smaller body size and lower fecundity compared to many other stock groups.

Escapement Methodology: For the CTC time series, escapements are estimated visually using expanded peak counts of spawners, holders, and carcasses in Spius Creek, Coldwater River, Louis Creek, and Bessette Creek. Escapements to the Deadman River are estimated by resistivity counter and to the Nicola River by MR and calibrated visual surveys. Escapements decreased in 2015 from levels observed in 2014; however, escapements exceeded those of the 2011 parental brood. Escapement was estimated at 5,800 in 2015.

The Nicola River is the exploitation rate indicator stock for the Fraser spring run age-1.2 stock group. A MR program provides high precision estimates of escapement by age and sex, and since 1995, Petersen disk tags have been applied by angling and examining postspawned salmon carcasses for the presence of marks. Estimates of escapement have been generated using pooled Petersen methods. The expanded peak count time series for the Nicola River is generally less than the MR estimates (Parken et al. 2003); therefore, the Nicola peak count time series has been calibrated to the MR data and is used prior to 1995 in the Fraser spring run age-1.2 aggregate time series (Figure 2.26 and Figure 2.27).

The MR estimated escapement of 4,836 in 2015 is lower than levels observed in 2014; however, the 2015 escapement exceeded that of the 2011 parental brood. Since 1995, hatchery-origin fish have averaged 24% of the spawning escapement (range: 4–62%).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this aggregate. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and electronic resistivity counter methods. Peak count estimates for the Nicola River from 1975 to 1994 have been calibrated to MR equivalents. Since 2004, the Nicola River escapements have been less than the median estimate of S_{MSY} (9,300; CV 21%) with the exception of 2014.

Agency Comments: The stock group has declined substantially over the last decade and is a stock of conservation concern.

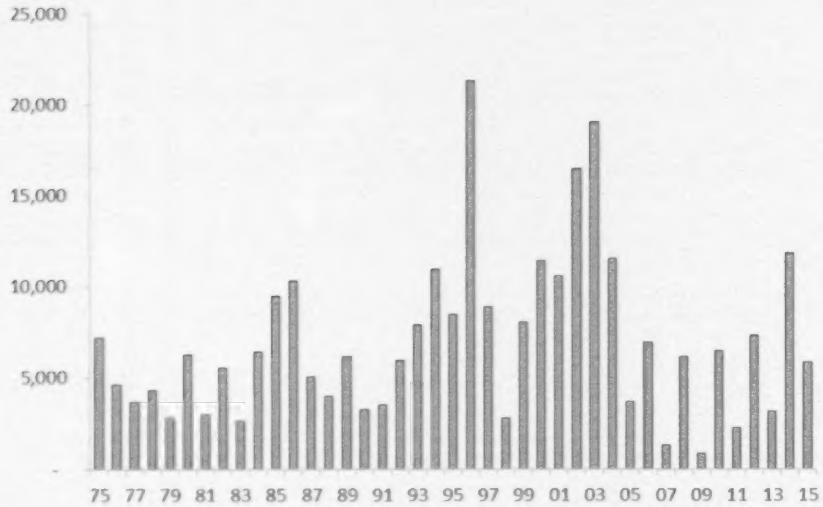

Figure 2.26.–Fraser River spring run age-1.2 stock group escapements of Chinook salmon, 1975–2015.

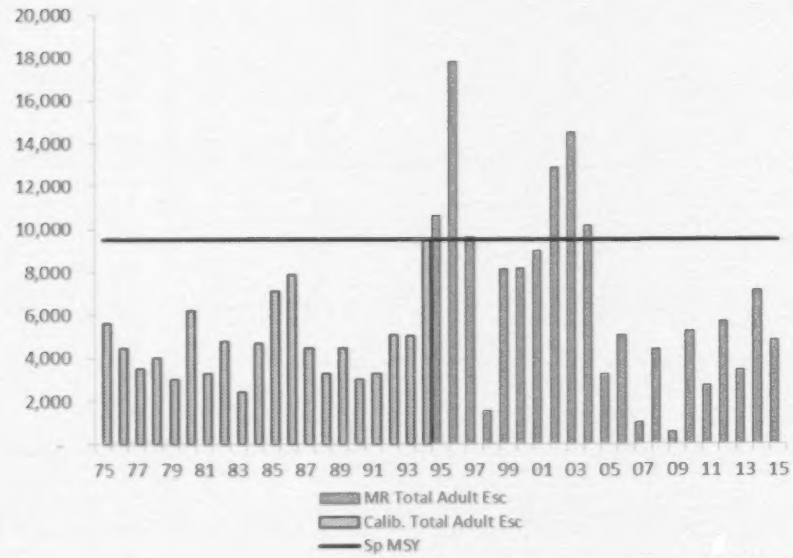

Figure 2.27.–Nicola River escapements of Chinook salmon, 1995–2015.

2.3.3.4.3 Fraser River Summer Run: Age 1.3

The Fraser River summer run age-1.3 aggregate includes 10 populations spawning in large rivers, mostly below the outlets of large lakes. These include the Nechako, Chilko, and Quesnel rivers in the Mid-Fraser and the Clearwater River in North Thompson watershed (CTC 2002b).

Escapement Methodology: Escapements are estimated by expanded peak counts of spawners,

holders, and carcasses surveyed from helicopters. Surveys of the Stuart River and North Thompson River were discontinued in 2004 due to unreliable counting conditions. Escapements in 2015 increased from those observed in 2014, and substantially exceeded levels estimated in the parental brood year in 2010. Aggregate escapement was estimated at 30,469 in 2015 (Figure 2.28).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for the aggregate. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and AUC methods.

Agency Comments: The stock group has declined over the last decade and is a stock of conservation concern.

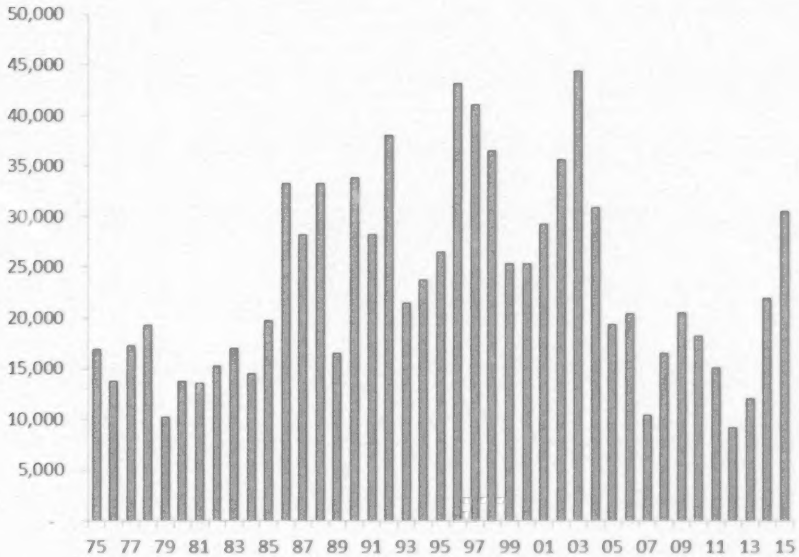

Figure 2.28.–Fraser River summer run age-1.3 stock group escapements of Chinook salmon, 1975–2015.

2.3.3.4.4 Fraser River Summer Run: Age 0.3

The Fraser River summer run age-0.3 aggregate includes six populations spawning in the South Thompson watershed and one in the Lower Fraser. These include the Middle Shuswap, Lower Shuswap, Lower Adams, Little River, and the South Thompson River mainstem in interior British Columbia, and Maria Slough in the Lower Fraser River (CTC 2002b).

Escapement Methodology: Escapements are estimated using peak count visual survey and MR methods. Escapements to stock group were high in 2015, although there was some variation within the stocks in this aggregate. The 2015 escapement estimate was 173,212 (Figure 2.29).

Since 2000 (with the exception of 2003), the Lower Shuswap River has been an exploitation rate

indicator stock for the Fraser summer run age-0.3 stock group, and a MR program provides the high precision estimates of escapement by age and sex. Tags have been applied to live fish by seining, and salmon carcasses were later examined for the presence of marks. In addition, there are multiple years of MR data for the Middle Shuswap River. The estimated escapement of 40.682 for Lower Shuswap in 2015 is slightly less than the 2014 estimate. Additionally, the 2015 escapement represents 173% of the 2011 parental brood of 20,322. Since 2000, hatchery-origin fish averaged 10% of the spawning escapement (range: 2–13%; Figure 2.30).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for the aggregate. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR methods and novel methods via the SSP. Peak count estimates for the Lower Shuswap River from 1975 to 1999 and for 2003 have been calibrated to MR equivalents. With the exception of 2012, Lower Shuswap River escapements have exceeded the median estimate of S_{MSY} (12,800; CV = 37%).

Agency Comments: Escapements had been increasing for this stock group over the last decade and the stock group has been healthy and abundant, with the exception of the 2012 escapement.

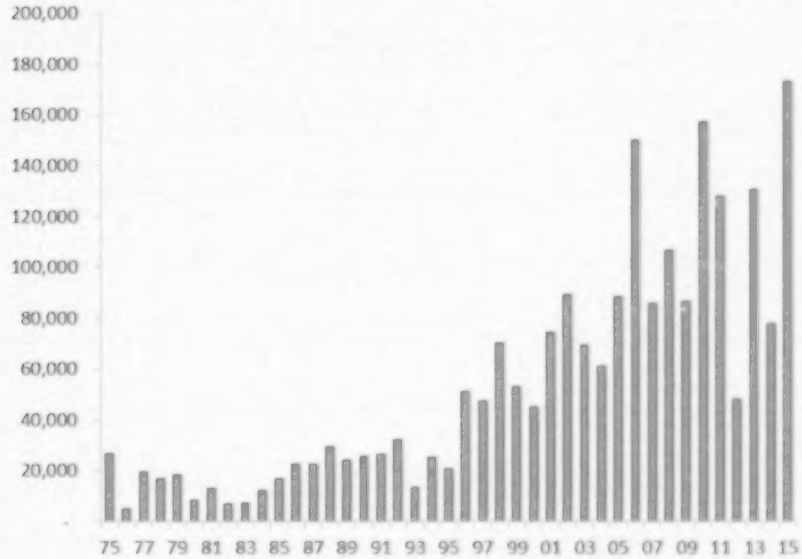

Figure 2.29.–Fraser River summer run age-0.3 stock group escapements of Chinook salmon, 1975–2015.

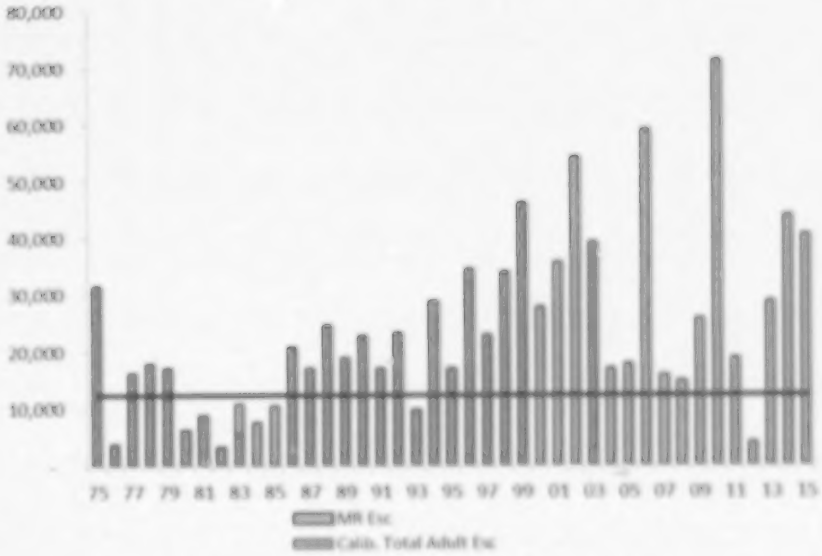

Figure 2.30.–Lower Shuswap River escapements of Chinook salmon, 1975–2015. The visual escapement estimates have been calibrated with the mark–recapture estimates.

2.3.3.4.5 Fraser River Late Run (Harrison River)

Escapement Methodology: Harrison River Chinook salmon are white-fleshed fish that return to spawn during the fall. They are unusual in that fry migrate into the lower Fraser River and estuary shortly after emergence. This stock spends 2–4 years in the coastal marine environment before returning to spawn. The Harrison River stock is one of the largest naturally spawning Chinook salmon populations in the world and makes important contributions to fisheries in southern British Columbia and Washington State. Since 1984, MR studies have been conducted annually on the Harrison River to obtain reliable estimates of spawning escapements. Spawning escapements to the Harrison River have varied widely from a low of 28,616 adults in 1995 to a high of 246,984 adults in 2003 (Figure 2.31). Escapements were more than 15% below the lower bound of the escapement goal from 2012 to 2014. The 2015 escapement estimate is 101,516 adult Chinook salmon, which is just above the upper escapement goal.

Escapement Goal Basis: Due to their natural abundance and importance in numerous British Columbia and Washington State fisheries, Harrison River Chinook salmon were designated as an escapement indicator stock (i.e., key stream indicator) to aid in fulfilling commitments under the 1985 PST. In 1986, an interim escapement goal for Harrison River Chinook salmon was established at 241,700 fish, based on doubling of the escapement estimate obtained from a MR program in 1984. In 2001, an escapement goal range was developed for Harrison Chinook salmon using a Ricker stock–recruit approach and is described in CTC (2002b).

The escapement goal range that was proposed was 75,100–98,500 (CV = 15%) with the upper bound equal to the upper 75% confidence limit derived from a bootstrap procedure. This range was reviewed and accepted by the CTC. Estimated spawning escapements in the Harrison have

exceeded this escapement goal range in 14 years from 1964 to the present. Escapements have fluctuated substantially with no apparent trend in the time series. Average contribution of enhanced fish is 2%.

Agency Comments: The stock has become a conservation concern due its low escapement over the last three years relative to the escapement goal.

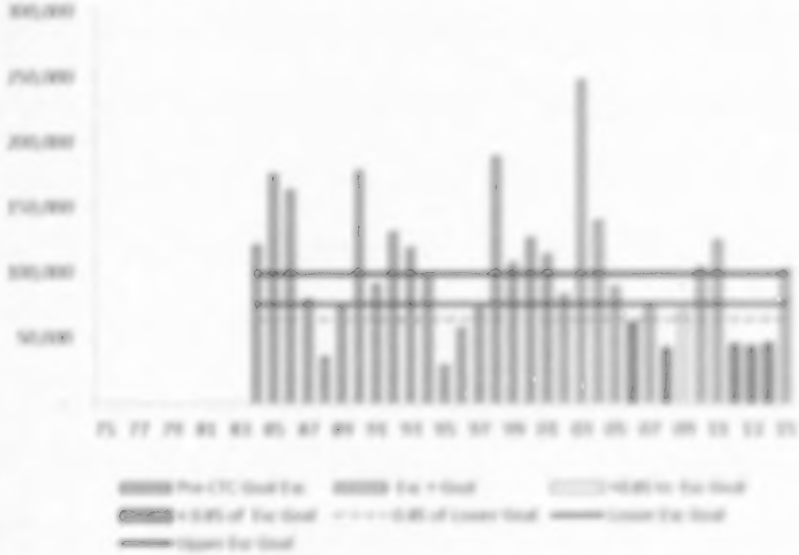

Figure 2.31.–Harrison River escapements of Chinook salmon, 1964–2015.

2.3.4 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

The PSC escapement indicator stocks in Washington and Oregon are currently separated into four regional groups: Puget Sound, Washington Coastal, Columbia River, and North Oregon Coastal. Far north migrating Chinook salmon from the mid-Oregon Coast are currently being incorporated in the PSC Chinook model in this year's base period recalibration. There are currently no CTC-agreed escapement indicator stocks for the MOC, although there have been two proposed (the South Umpqua and Coquille). The indicator stocks include a variety of run timings and ocean distributions. Some of these indictor stocks are components in the different stock groups listed in Attachment I–V tables in the 2009 Agreement.

Biologically based escapement goals have been reviewed and accepted by the CTC for three fall stocks (Queets, Quillayute, and Hoh) in coastal Washington, two spring/summer stocks (Queets and Hoh), four Columbia River stocks (Lewis, Upriver Brights, Deschutes, and Mid-Columbia Summers), and three far north migrating Oregon coastal stocks (Nehalem, Siletz, and Siuslaw).

2.3.4.1 Puget Sound

Puget Sound escapement indicator stocks include spring, summer/fall and fall Chinook salmon

stocks from the Nooksack, Skagit, Stillaguamish, Snohomish, Lake Washington, and Green river systems. They tend to have a more local distribution than most coastal and Columbia River stocks and are caught primarily in WCVI AABM fisheries, and Canadian and US ISBM fisheries. Escapement for these stocks is assessed as the total number of natural- and hatchery-origin fish spawning naturally on the spawning grounds.

2.3.4.1.1 Nooksack River

The Nooksack River drains into Puget Sound just north of Bellingham. The Nooksack spring Chinook salmon stock includes early timed populations returning to the north and south forks of the Nooksack River.

Escapement Methodology: Estimates of the escapement in the south fork have traditionally been based on the number of redds observed prior to the first of October expanded by 2.5 spawners per redd. Since 1999, this estimate has been further refined by separating hatchery-origin strays (north/middle fork and summer/fall Chinook salmon) based on CWTs, otolith marks or adipose fin clips, and also by assigning the natural-origin spawners to the south fork, north/middle fork, and fall hatchery stocks. The latter step is based on the expansion of the microsatellite DNA stock assignment of carcasses collected through the first week of October applied to the total estimated natural-origin spawners. The majority of the run and the escapement to the spawning grounds is composed of hatchery-origin returns from two supplementation programs. Owing to the influence of glacial runoff, estimates of escapement in the north and middle forks are based on a combination of field methods, including carcass and redd counts (i.e., in clear tributaries and during clear/low-flow mainstem conditions). Due to spawn timing differences, north fork/middle fork escapement estimates are assumed to be spring Chinook salmon only, and natural/- and hatchery-origin fish are identified based on carcass marks (CWT, otolith thermal marks, adipose clips). For 2013, the estimate of total escapement was 1,330, with 100 natural-origin spawners in the north/middle fork and 10 natural-origin fish in the south fork. The preliminary 2014 estimate of total spawners is 1,335, which is similar to 2013; hatchery- and natural-origin composition is not yet available (Figure 2.32). Escapement estimates are not yet available for either population for 2015.

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

Agency Comments: The state-tribal escapement goal established for this Chinook salmon management unit is an upper management threshold (UMT) of 4,200 spawners and a low abundance threshold (LAT) of 2,000 natural-origin fish (CCMP 2010). The UMT as established by the state-tribal managers is generally considered as the adult (age 3+) escapement level associated with maximum sustained harvest. The LAT is the escapement level below which dramatic declines in long-term productivity could occur. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.

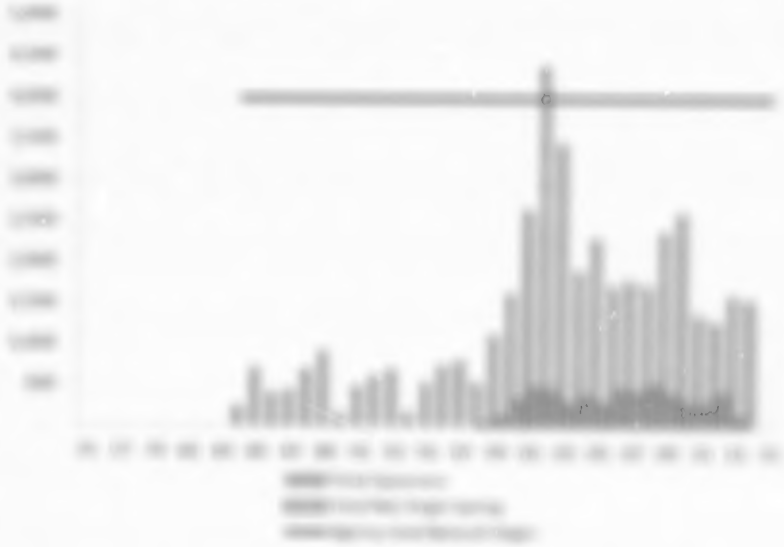

Figure 2.32 –Nooksack River escapement of total (natural- and hatchery-origin) and natural-origin spring Chinook salmon, 1980–2014.

2.3.4.1.2 Skagit River Spring

The Skagit River drains into northern Puget Sound near Mount Vernon, and is the largest drainage basin in Puget Sound. The Skagit River spring Chinook salmon stock includes early-timed populations returning to the Upper Sauk, Cascade, and Suiattle rivers.

Escapement Methodology: Due to changes in spawning index areas, beginning in 1992 for the Cascade stock and 1994 for the Sauk and Suiattle stocks, escapements are not directly comparable to previous numbers. In the Upper Sauk, cumulative redd counts are conducted from river mile 32.8 to 39.7 (Cascade below White Chuck river mouth to the confluence of the North and South Fork Sauk), in the North Fork Sauk from the mouth to the falls, and in the South Fork Sauk (river mile 0 to 5.0). This method replaced the peak live and dead count approach in 1994. In the Cascade River, cumulative redds are counted in the mainstem upstream of river mile 6.1 to the forks at 18.8 in the lower north fork and south fork, and in Found, Kindy, and Marble creeks. In the Suiattle basin, cumulative redds are counted in mainstem Suiattle, and in Big, Tenas, Straight, Circle, Buck, Lime, Downey, Sulphur, and Milk creeks. Prior to 1994, peak live and dead fish counts in Big, Tenas, Buck, and Sulphur creeks were used. Escapement may include very small numbers of hatchery strays in these natural production areas. Fall PSC funded studies on straying of Marblemount hatchery spring Chinook salmon focused on the area immediately adjacent to the hatchery which is outside the survey reach for natural production. The preliminary 2013 escapement estimate was 1,800 natural spawners (Figure 2.33).

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock.

Agency Comments: The current UMT used by the state and tribal comanagers for the Skagit

River spring Chinook salmon management unit is 1,000 wks-yr of 0.0% (CNMF 2010). Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate ceiling rather than for a MAF or LAF escapement.

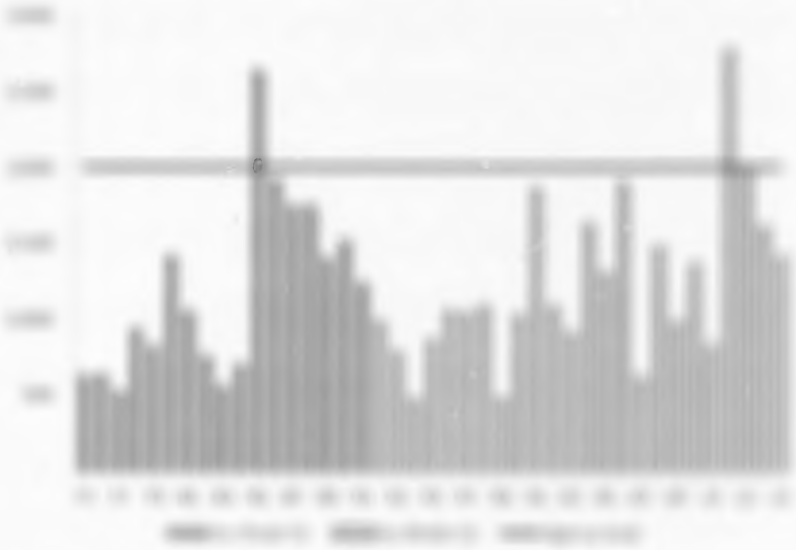

Figure 5.68. Illegal River escapement of spring Chinook salmon to the spawning grounds, 1979-2010.

5.5.6.5.3 Illegal River Summer/Fall

The illegal River summer/fall Chinook salmon stock includes the upper illegal River summer, back summer, and lower illegal River fall run populations.

Escapement Methodology: Escapement of illegal River summer/fall Chinook salmon was estimated using expansion of total counts from helicopter surveys of mainstem areas and foot surveys of smaller tributaries. The counts are expanded by the 0.01 method (Smith and Lyons 1994). This method assumes a 15-day weld life and 1.5 which assumes the spot estimated weld. Natural escapement is predominantly offspring from natural origin parent spawners; the remainder is hatchery origin fish from the wild stock tagging program that started in 1996. Natural escapement does not include the brood stock collected for this program. The preliminary 2010 escapement estimate was 15,000 (Figure 5.68).

Escapement Goal Basis: There is currently no CTC accepted escapement goal for this stock group.

Agency Comments: The LAF used by the state initial conjugates for the illegal River summer/fall Chinook salmon management unit is 16,000, based on a recent assessment of freshwater productivity and accounting for variability and biases in management since 1996 (2010). The LAF is 6,000 spawners. Since its listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate ceiling rather than for a MAF

[illegible]

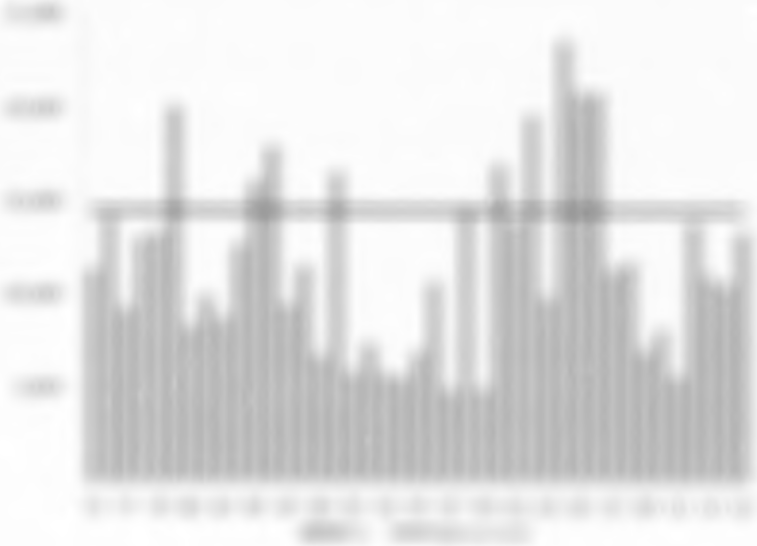

Figure [illegible]: Allegiant Whale escapement of summer/fall Kilmouth salmon to the spawning grounds, [illegible]

[illegible] Allegiannish River

The Allegiannish River drains into [illegible] Kilmouth salmon. The Allegiannish River has two populations of Kilmouth salmon: Allegiannish A (upper) [illegible] Allegiannish River has two populations of Kilmouth salmon: Allegiannish A (upper) [illegible] Allegiannish River [illegible] Allegiannish River [illegible] Allegiannish River

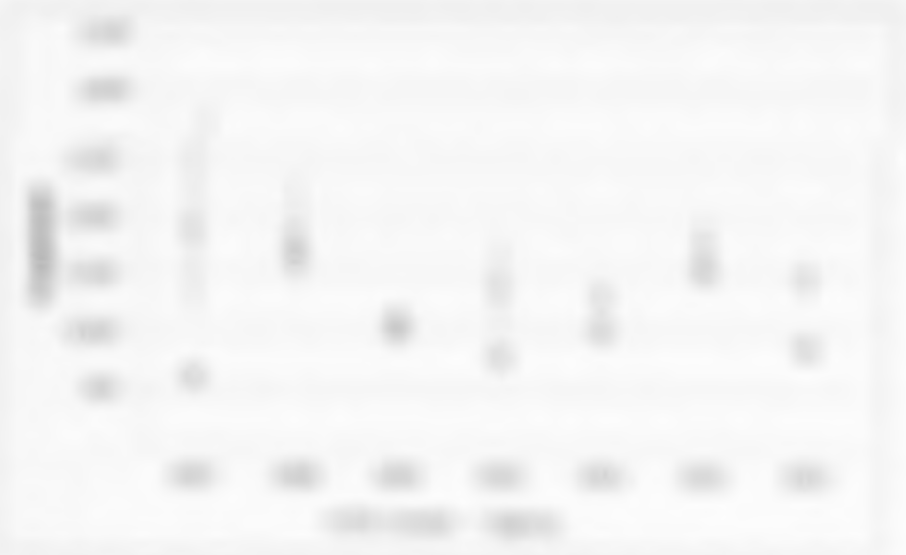

Figure 2.1.3 – Differentiation Effect on Transmission. Left: Transmission probability as a function of cell cycle stage for undifferentiated (blue) and differentiated (red) cells. Differentiation reduces transmission at every stage, with the largest reduction in S phase (stage 0.04–0.05). Right: Transmission probability as a function of differentiation level, averaged over all stages. Transmission falls from 0.72 for undifferentiated cells to 0.31 for fully differentiated cells. Error bars: ±1 SD across 1,000 simulations.

2.1.4 Cell Cycle Effects

The cell cycle effect on transmission is mediated by two distinct mechanisms. First, the probability of successful transmission varies across the cell cycle because the cell's internal state changes during growth and division. Second, the probability of successful transmission varies across the cell cycle because the cell's internal state changes in response to environmental conditions. These two mechanisms are independent and can be analyzed separately.

Mechanism 1: Internal Cell Cycle Effect. The probability of successful transmission at cell cycle stage s is given by:

$$P_{internal}(s) = P_{base} \times \left(1 - \frac{s}{s_{max}}\right)$$

where P_{base} = 0.72 is the baseline transmission probability for a newly divided cell, s_{max} = 0.08 is the maximum cell cycle stage, and s ranges from 0 (cell division) to s_{max} (next division). This formula produces a linear decline in transmission from 0.72 at $s = 0$ to 0.36 at $s = 0.08$. The linear form is chosen because it is the simplest monotonic function that captures the observed decline without introducing additional parameters. Alternative functional forms (exponential, sigmoid) were tested in sensitivity analysis and produced qualitatively similar results.

Mechanism 2: Environmental Effect. The probability of successful transmission at cell cycle stage s in environment e is given by:

$$P_{environment}(s, e) = P_{base} \times \left(1 - \frac{s}{s_{max}}\right) \times \left(1 - \frac{e}{e_{max}}\right)$$

where e is the environmental stress level and e_{max} = 0.8 is the maximum stress level. This formula produces a multiplicative interaction between cell cycle stage and environmental stress. At $e = 0$ (no stress), the formula reduces to the internal effect. At $e = e_{max}$, transmission is reduced to zero regardless of cell cycle stage. The multiplicative form is chosen because it implies that the effect of stress is proportional to the cell's internal state, not independent of it. Alternative functional forms (additive, exponential) were tested in sensitivity analysis and produced qualitatively similar results.

Parameter Estimation. P_{base} = 0.72 is estimated from the baseline transmission probability in the control condition (no stress, $e = 0$). s_{max} = 0.08 is estimated from the observed cell cycle duration in the simulation. e_{max} = 0.8 is estimated from the observed range of stress levels in the simulation. These parameters are not fitted to data from the experiment described in Section 2.1.5. They are fixed before the experiment and are used to predict the experimental results.

Sensitivity Analysis. The cell cycle effect is robust to parameter variation. Varying P_{base} from 0.60 to 0.84 changes the overall transmission rate but not the relative effect of cell cycle stage. Varying s_{max} from 0.06 to 0.10 changes the slope of the decline but not its direction. Varying e_{max} from 0.6 to 1.0 changes the interaction between stress and cell cycle stage but not the main effect of cell cycle stage. The qualitative conclusion that transmission is highest in early cell cycle stages and lowest in late cell cycle stages is robust to all parameter variations tested.

2,800. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement. In 2014, WDFW and the Tulalip Tribe reviewed, reconciled, and updated the historic escapement time series for the Snohomish Basin; this resulted in minor changes to the data series.

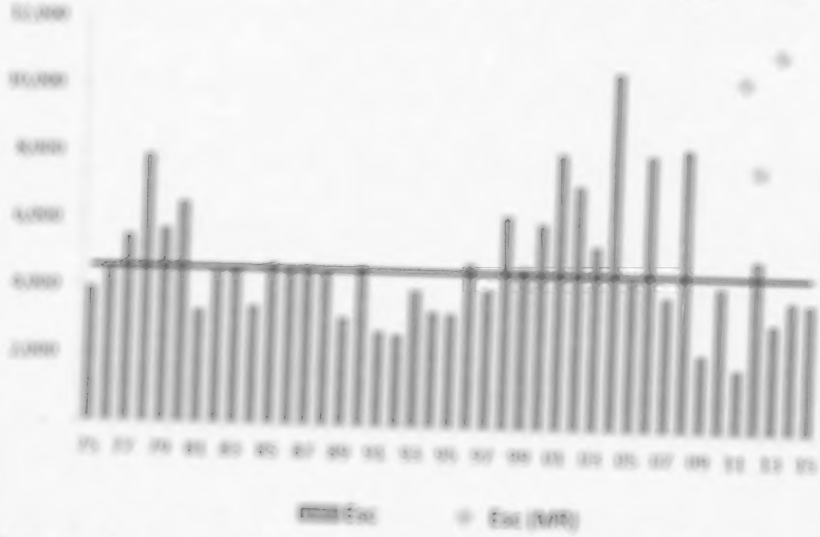

Figure 2.37.–Snohomish River escapement of Chinook salmon to the spawning grounds, 1975–2015.

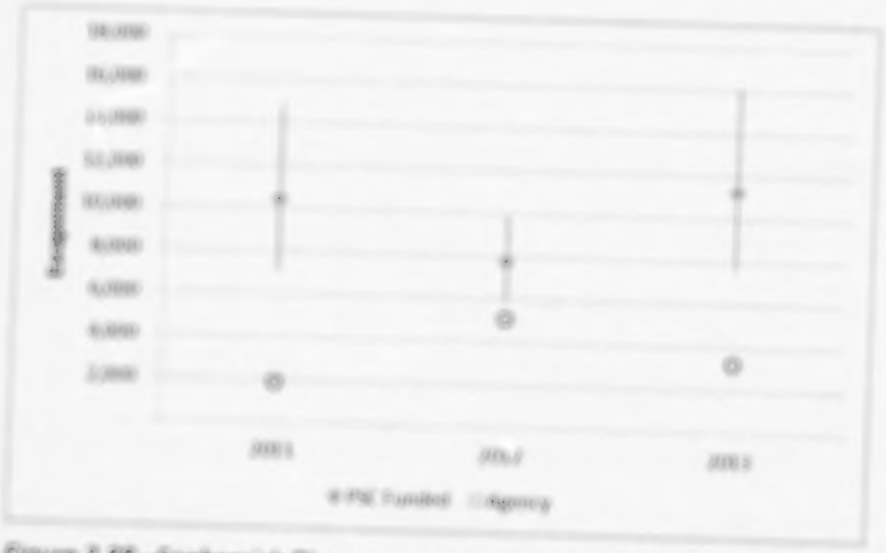

Figure 2.38.–Snohomish River escapements of Chinook salmon to the spawning grounds in years when both agency expanded redd counts were used (circles) and when genetic mark–recapture (GMR) estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with SSP funding.

2.3.4.1.6 Lake Washington

The Lake Washington Chinook salmon stock includes the fall run populations in the Cedar River and in the North Lake Washington tributaries of Bear, Cottage, and Issaquah creeks. A hatchery is located on Issaquah Creek, and Chinook salmon spawning in Issaquah Creek are not included in the natural escapement for Lake Washington.

Escapement Methodology: Escapement in the mainstem Cedar River is estimated using expansion of total redd counts. Prior to 1999, live counts and AUC methods were used to estimate spawning abundance in the Cedar. Past AUC estimates have been converted to redd-based estimates using simple linear regression. Escapement estimates are considered a complete census, where every Chinook redd in the Cedar system is counted. It should be noted that although there are no hatchery fish released into the Cedar River, an average of 23% of the spawners from 2003 to 2008 were adipose clipped from mass-marked hatchery production, presumably from Issaquah Hatchery (CCMP 2010). Escapement to the North Lake Tributaries is estimated using live counts and AUC methods in Bear and Cottage Lake creeks. Index surveys in Bear Creek began in 1981; index surveys in lower Cottage Lake Creek began in 1983, and were expanded in 1997 to include upper Cottage Lake Creek (considered a nonindex area). Past AUC estimates of index areas have been converted to AUC estimates of both index and nonindex area using simple linear regression. The majority of natural spawners in Bear and Cottage Lake creeks are hatchery-origin fish, likely strays from the Issaquah hatchery. Natural spawners in Issaquah Creek that spawn below the Issaquah Hatchery are not included in the graph. The 2015 escapement for Lake Washington was 2,014 spawners; 1,798 in the Cedar River and 216 (of which 52 were natural-origin fish) in Bear and Cottage Lake creeks (Figure 2.39).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: A state–tribal interim UMT escapement goal of 1,200 Chinook salmon for an index reach in the Cedar River was established in 1993 based on average escapements from 1965 to 1969. This goal for the index reach was converted to 1,680 Chinook salmon for the entirety of the river downstream of the dam and reflects a redd-based escapement value consistent with the interim escapement goal derived using AUC methodology. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement in the Cedar River; however, when the UMT is expected to be exceeded, some additional fishing in Lake Washington is considered.

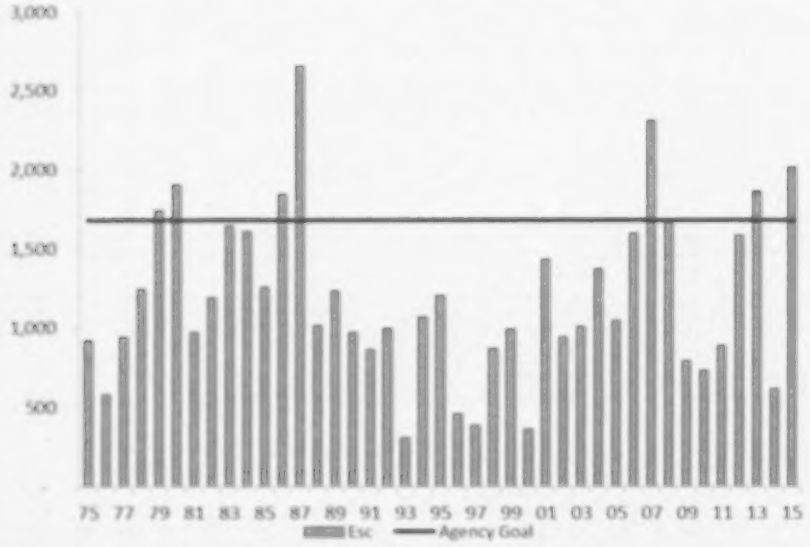

Figure 2.39.–Escapement of Chinook salmon to the spawning grounds in the tributaries of Lake Washington (Cedar River and Bear and Cottage creeks), 1975–2015.

2.3.4.1.7 Green River

The Green River fall Chinook salmon stock consists of a single population spawning in the mainstem Green River and two of its major tributaries, Newaukum and Soos creeks.

Escapement Methodology: Escapement is estimated from a redd count expansion method that has varied over the time series by the extent of spawning survey coverage. The method used until about 1996 involved an index area redd count multiplied by 2.6 to estimate total redds, then multiplied by 2.5 fish per redd to produce estimated escapement. The 2.6 index to total redd expansion factor was based on a 1976 to 1977 US Fish and Wildlife Service MR study. Since 1996, the survey areas have broadened and the associated expansion factor of 2.6 has been reduced to the point that the redd counts in 2009 have complete spawning reach coverage. The method used in recent years provides natural escapement estimates for the mainstem Green River and Newaukum Creek. Newaukum Creek redds are counted during foot surveys. The mainstem Green River is surveyed by boat and by air. Some parts of the river (i.e., the Gorge) are only surveyed by air. Boat surveys are generally done once a week, or twice a week in years with a large numbers of pink salmon. One aerial survey is made during the peak of spawning, more if budgets permit. Certain index reaches of the river are surveyed every week by boat to develop a cumulative redd count total for those reaches. These index reaches are distributed throughout the river. Visible redds are counted for the entire floatable part of the river by boat each week and for the entire river by helicopter during the peak. The ratio of visible redds seen by boat to those seen by air (boat surveys assumed to be best) is used to estimate how many redds would be seen by boat in the unfloated reaches. This provides an estimate of how many visible redds exist during the peak of spawning. To get from peak redds

to cumulative total redds, the visible redds in the index reaches during the peak are compared to the season total for those index reaches. Different areas of the river have different ratios of peak visible redds to season totals. Expansion of nonindex visible redds to season total redds uses the ratio from nearby index reaches of the same general character. The CTC considers these estimates from redd counts as index values rather than estimates of total escapement. Estimates of total escapement from MR studies in 2000, 2001, and 2002 funded through the US Letter of Agreement were about 2.5 times higher than the escapement estimate from redd count expansion. In 2010, 2011 and 2012, the MR-based escapements from studies funded under the SSP were once again more than twice as high as the redd count expansion estimates (Figure 2.40 and Figure 2.41). There is a large hatchery program in this basin and these fish comprise a large portion of the return. Hatchery fish contribution to the natural escapement ranged from 53% to 65% for the years 2004 to 2007. The escapement in 2015 from redd count expansion was 4,087 mixed hatchery- and natural-origin Chinook salmon.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state–tribal UMT escapement goal of 5,800 naturally spawning adults is the average of the 1965 to 1976 escapements (Ames and Phinney 1977). The LAT is 1,800 fish. Since its listing in 1999 as threatened under the ESA, annual fishery management for this stock has been a ceiling exploitation rate in the southern US preterminal fisheries, and a UMT in the terminal fisheries.

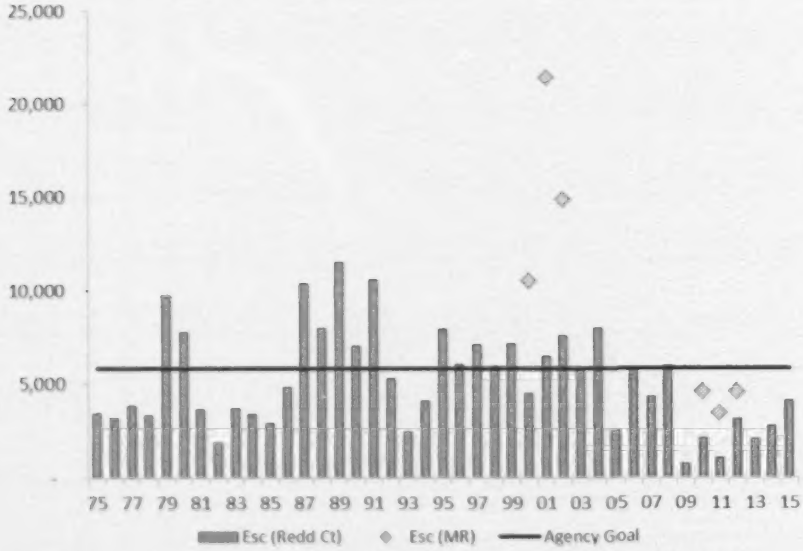

Figure 2.40.–Green River escapement of Chinook salmon to the spawning grounds, 1975–2015.

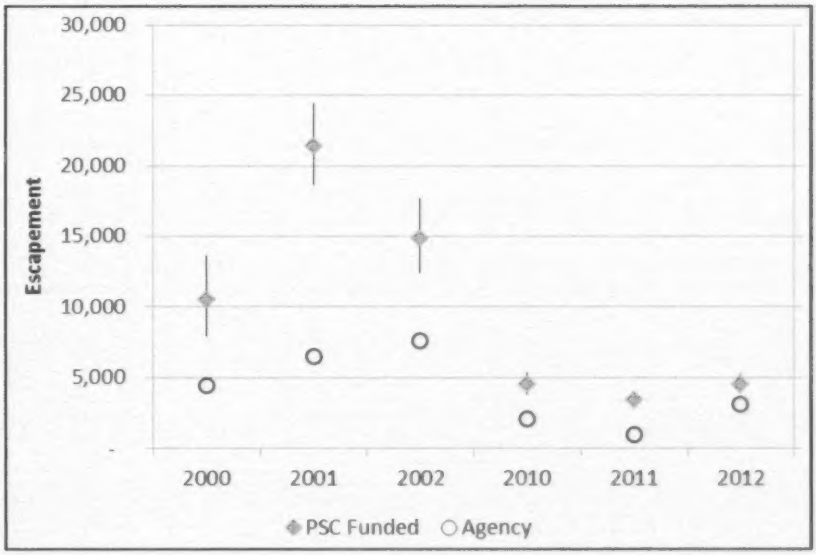

Figure 2.41.–Green River escapements of Chinook salmon to the spawning grounds in years when both agency expanded redd counts were used (circles) and when conventional (2001–2002) and genetic (2010–2012) mark–recapture estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Letter of Agreement or SSP funding.

2.3.4.2 Coastal Washington

Coastal Washington stocks include spring, summer, and fall Chinook salmon from the Hoko, Quillayute, Hoh, and Queets rivers, and from Grays Harbor. Coastal Washington stocks have a northerly distribution and are vulnerable to southern US fisheries primarily as mature fish during their spawning migrations. They are caught primarily in SEAK and NBC AABM fisheries and in terminal net fisheries.

2.3.4.2.1 Hoko River

The Hoko River is located at the extreme western end of the Strait of Juan de Fuca and is not a population listed under the ESA as part of the Puget Sound Chinook Salmon Endangered Species Unit. Hoko River Chinook salmon spawn primarily in the mainstem of the Hoko River, with limited spawning in larger tributaries.

Escapement Methodology: The Makah Tribe and WDFW conduct ground surveys using cumulative redd counts for the mainstem (Hoko) and tributaries found between river mile 1.5 and 21.7, which represents the entire range of spawning habitat utilized by Chinook salmon. Redd counts are multiplied by 2.5 adults per redd. There are 10 mainstem reaches plus 13 tributary reaches, including Little Hoko, Browne's, Herman, North Fork Herman, Ellis, Bear, and Cub rivers, which are all upper mainstem tributaries. The tribe also surveys the mainstem Sekiu River; and Carpenter, South Fork Carpenter, Sunnybrook, and unnamed creeks 19.0215, 19.0216, and 19.0218. Escapement excludes brood stock collected from the spawning grounds for the supplementation program which started in 1988 and has collected an average of 178

fish annually through 2014. In 2015, 444 fish were retained for the supplementation program leaving a total natural spawning escapement estimate of 2,283 mixed natural origin and returns from the supplementation program (Figure 2.42).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The UMT escapement goal established by state and tribal comanagers is 850 naturally spawning adults. This goal was developed as a proxy for the spawning escapement for MSY. The escapement goal was calculated using a habitat-based approach (rather than a stock–recruitment analysis) by estimating the amount of available spawning habitat, then expanded utilizing assumed optimal redds per mile and fish per redd values (Ames and Phinney 1977).

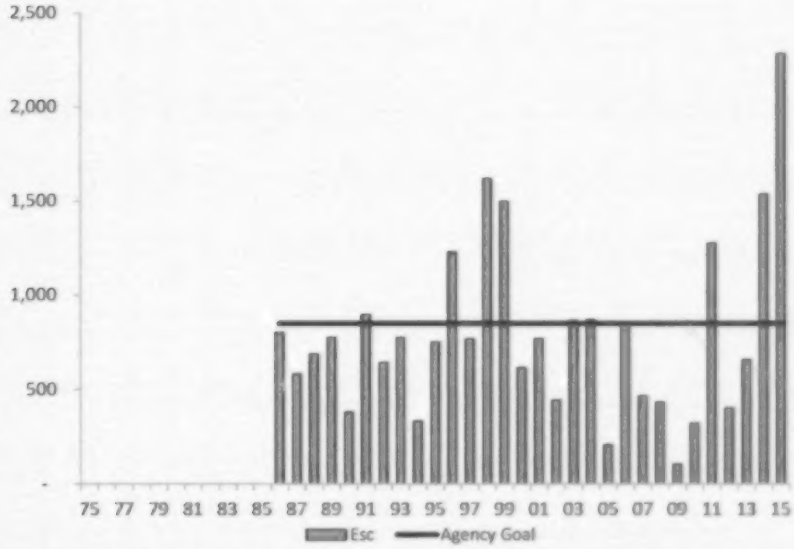

Figure 2.42.–Hoko River escapement of Chinook salmon to the spawning grounds, 1986–2015.

2.3.4.2.2 Quillayute River Summer

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast.

Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, mainstem Calawah, North Fork Calawah, and Sitkum rivers. This has been used consistently in the Quillayute River System since the 1970s. Surveys are conducted by foot, raft, drift boat, and helicopter, and index areas are surveyed either weekly or biweekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River

system stream mileage base that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2015 escapement estimate for summer Chinook salmon was 824 (Figure 2.43).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state–tribal management goal for this stock is 1,200 adults and jacks combined (PFMC 2003).

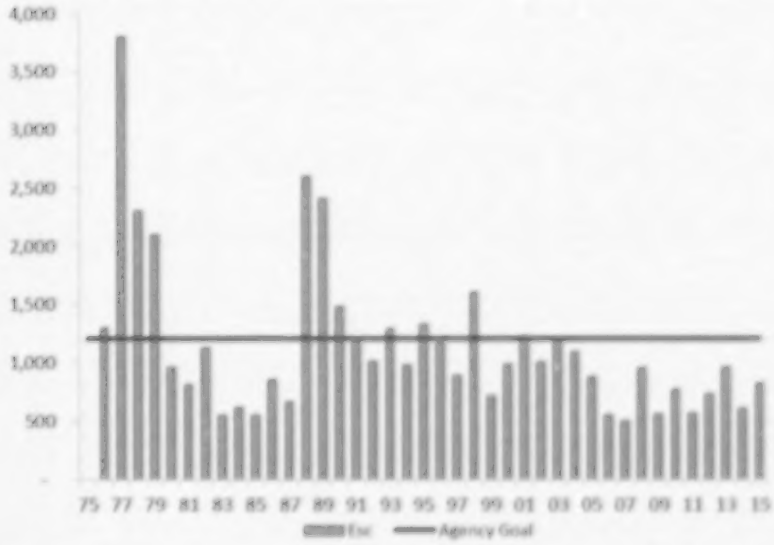

Figure 2.43.–Quillayute River escapement of summer Chinook salmon to the spawning grounds, 1976–2015.

2.3.4.2.3 Quillayute River Fall

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast. It is one of three Washington coast river systems that contain fall Chinook salmon with CTC-approved escapement goals.

Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, Sol Duc, Dickey, Calawah rivers and several other smaller tributaries in the basin. This has been used consistently in the Quillayute River System since the 1970s. Surveys are conducted by foot, raft, drift boat, and helicopter, and index areas are surveyed either weekly or biweekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River system stream mileage base that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement.

The 2015 escapement estimate was 3,090 (Figure 2.44).

Escapement Goal Basis: In 2004, the CTC approved an escapement goal for Quillayute fall Chinook salmon of 3,000 natural spawners based on a spawner–recruit analysis developed by Cooney (1984) and ODNR (1982).

Agency Comments: Terminal fisheries are managed for a harvest rate of 40%, with an escapement floor of 3,000 fish (PFMC 2003). This objective is designed to actively probe at and above estimates of escapements that produce maximum sustained harvest, while minimizing potential detrimental effects of existing fisheries. Stock production analyses of spawning escapements from 1968 to 1982 were used to determine the initial escapement floor.

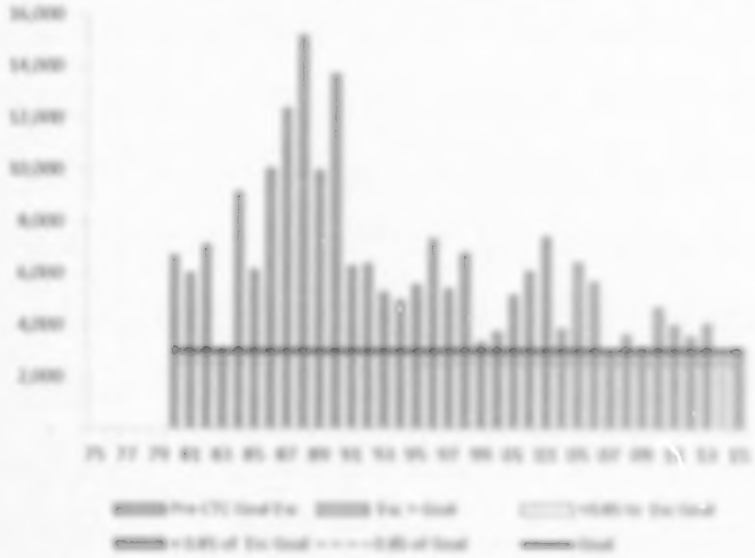

Figure 2.44.–Quillayute River escapement of fall Chinook salmon to the spawning grounds, 1980–2015.

2.3.4.2.4 Hoh River Spring/Summer

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south.

Escapement Methodology: Escapement is estimated from redd counts in index areas, supplemental surveys in the mainstem and south fork of the Hoh River, and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record new and visible redds. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Surveys are also conducted in reaches too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity, and spawner abundance estimates are derived using index timing curves. For areas with

suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish per redd. There is no hatchery program in this system. The 2015 natural escapement estimate was 1,070 fish (Figure 2.45).

Escapement Goal Basis: Escapement floor policy of 900 for the Hoh spring/summer Chinook salmon was developed by Cooney (1984) and QDNR (1992), based on spawner–recruit analyses, and was accepted by the CTC in 2004.

Agency Comments: Similar to many of the other Washington coastal stocks, Hoh River spring/summer escapements have been relatively stable except for much larger returns in 1988, 1989, and 1990. The terminal return for this stock declined from 1997 to 2000, had rebounded in 2001 before declining again since 2005. Terminal fisheries are managed to catch 10% of the river run, with an escapement floor of 900 fish (PFMC 2003). This objective is designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock. Stock production analysis of spawning escapement for brood years 1969 to 1976 was utilized to determine the initial escapement floor.

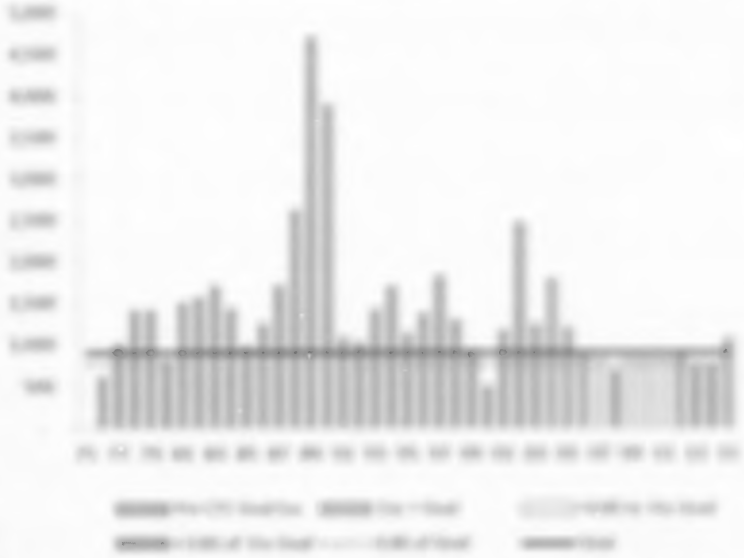

Figure 2.45.–Hoh River escapement of spring/summer Chinook salmon to the spawning grounds, 1979–2015.

2.3.4.2.5 Hoh River Fall

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south. It is one of three Washington coast river systems that contain fall Chinook salmon with CTC-approved escapement goals.

Escapement Methodology: Escapement is estimated from redd counts in index areas, supplemental surveys in the mainstem and south fork Hoh River, and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted infrequently in additional monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.1 fish per redd. The natural escapement estimates for Hoh River fall Chinook include a small number of fish taken for an experimental hatchery program from 1983 to 1986, but otherwise should be considered natural-origin fish. The 2010 escapement estimate is 1,292 fish (Figure 3.46).

Escapement Goal Basis: The escapement floor of 1,200 for the Hoh fall Chinook salmon was developed by Cooney (1986) and QDNR (1992), based on spawner-recruit analyses, and was accepted by the CTC in 2004 as the escapement goal.

Agency Comments: The state-tribal management plan for this stock includes a harvest rate of 40% of the terminal run, with an escapement floor of 1,200 spawners (PFMC 2003). This objective is designed to actively probe at and above estimates of the escapements that produce maximum sustained harvest, while minimizing potential detrimental effects of existing fisheries. Stock production analyses of spawning escapements from 1968 to 1982 were utilized to determine the critical escapement floor.

Figure 2-46. Hoh River escapement of Sol Ditmark salmon to the spawning grounds, 1979-2010.

5.5.6.5.9 Sweets River Spring/Summer

The Sweets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River.

Escapement Methodology: Escapement is estimated from redd counts from August 15 to October 15 for spring/summer Ditmark salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total live and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted infrequently in additional monitored stream areas utilized by spawning Ditmark salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves for areas with suitable habitat but not regularly surveyed. Redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated under the assumption of 1.7 fish per redd. The 2010 estimate of natural escapement was 132 fish (Figure 2-47).

Escapement Goal Basis: Escapement floor policy of 700 for Sweets spring/summer Ditmark salmon was developed by Cooney (1984) and SSPM (1985), based on spawner interval analysis.

and was concentrated by the 1773 to 1890 by the occupancies signals. Good productions analysis of sparrowhawk occupancies the choose years 1890 to 1970 years used to determine the total occupancies there.

Sparrow Commonness Survived Kilometre was managed by the week and Kites to count 1970 of the week was only, with no occupancies there of 100 kite (0%96–1000). The observers to occupancies activities provide a note above the estimates of occupancies that produce 900 – those 1400 survived Kilometre have had selected longest on the week, as returns to Kites was there week, consistent the occupancies there. Those 1890 – each coughs have been reported to release of Kilometre upheaval bringing the summer, and Kites Kites by have been checked to one Kites walking day the environmental and subsistence scenarios.

Figure 0.0.0 – Queens River occupancies of sparrowhawk Kilometre without to the sparrowhaw grounds, 1970–2000.

0.0.0.0.0 Queens River Hall

The Queens River stretch from the western side of Kite Reserve Mountains to the north Washington coast and to south of Kite Hold River. It is one of three Washington coast river systems that contain 100 Kilometre salmon with 170 sparrowhawk occupancies signals.

Occupancies Methodology Occupancies to estimate of from radio counts from Kilometre 10 to Kite Hold. 170 100 Kilometre salmon. Survey was conducted by thick, rocky, and inaccessible riverbeds, monitored Kites reaches was a prequalit quality to record hold was not a little cattle observed. Cumulative radio counts the count radio reach represents the total sparrow abundance the that particular sparrowhaw area. Whether radio radio counts to radio reaches was used to estimate sparrowhaw bridge counts the estimated by the occupancies of reaches cumulative radio that was radio to count radio survey area. Kilometre surveys was also monitored infrequently to additional monitored known survey utilized by sparrowhaw Kilometre salmon. Those

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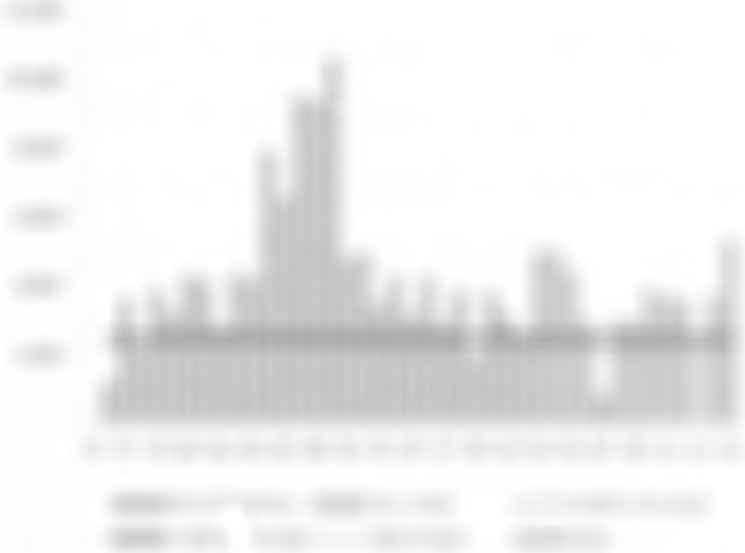

Figure 2.1.18 – Square Metal Accessories of Edith Wilkinson Jewelry on the Lakeshore Journey, 2010–2012

[illegible] Grays Harbor Spring

Grays Harbor spring Wilkinson jewelry opened symmetrically in the upper machine of Kaminskaya Metalwork Works and in Montevideo.

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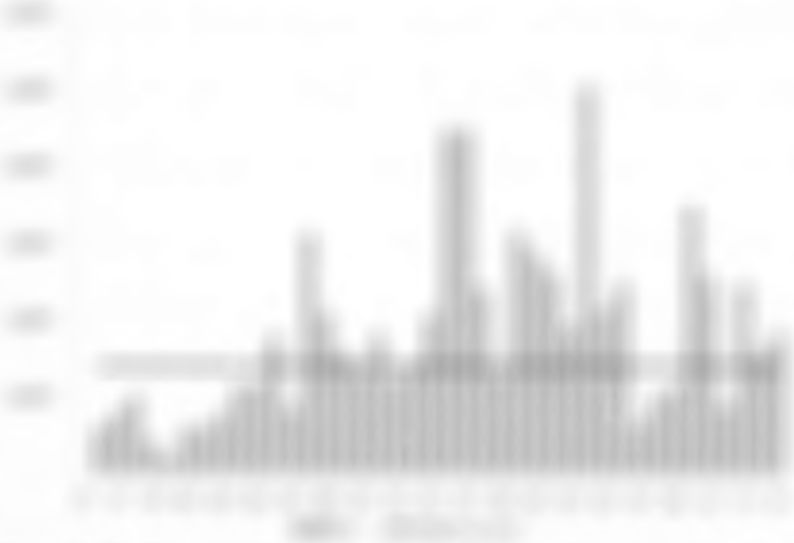

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Humptulips and Satsop rivers where fall Chinook salmon hatchery facilities are located, and in smaller tributaries such as the Wishkah and Hoquiam rivers that flow directly into the harbor.

Escapement Methodology: Escapement is estimated from redd counts from October 15 to December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted infrequently in additional monitored stream areas utilized by spawning Chinook salmon. These extensive reaches encompass areas too large or remote to intensively monitor throughout the season. Extensive surveys are timed as close as possible to peak spawning activity. Extensive reach spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated under the assumption of 2.5 fish per redd. The 2005 escapement was 22,200 spawners (Figure 2.50).

Escapement Goal Basis: In February, 2006 the CTC reviewed a spawner-recruit analysis by Quinault Department of Natural Resources and WDFW that identified a biologically based spawning escapement goal. The CTC provisionally accepted the presented goal (13,500) and provided comments necessitating minor re-analysis and report revision. The final adopted goal is 13,506 (QDNR and WDFW 2006).

Agency Comments: Consistent with the stock group in Attachments I, II, and V of the 2009 Agreement, the Grays Harbor fall Chinook salmon escapement goal will be applied in CTC stock-performance evaluations on a stock aggregate basis. This goal, however, is the sum of tributary-specific goals that were derived separately for the Chehalis and Humptulips rivers.

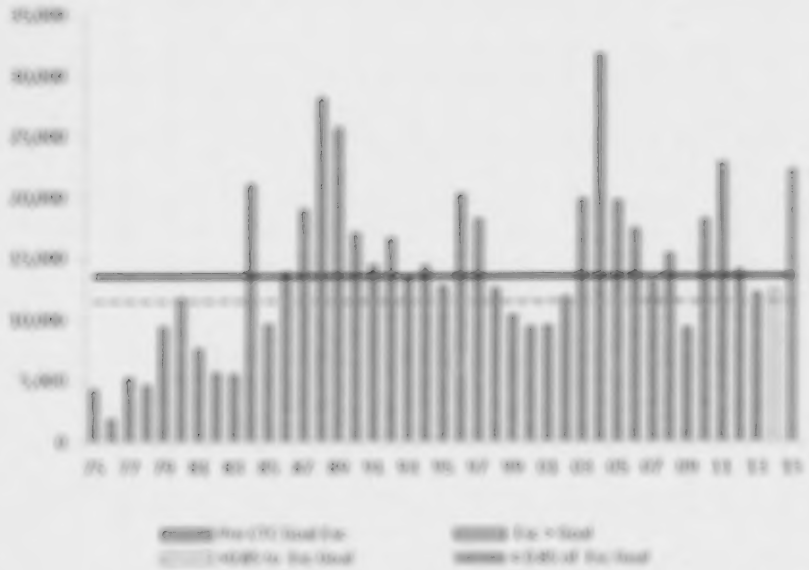


Figure 2.50.–Grays Harbor escapement of fall Chinook salmon to the spawning grounds, 1970–2015.

Note: The displayed agency goal line (14,600) relates to the agency goal in effect through 2013; the recently CTC-agreed escapement goal (13,326) will be used in assessments from 2014 onward.

2.3.4.3 Columbia River

Columbia River stocks include spring, summer, and fall Chinook salmon from the Columbia River and its tributaries. Runs may have markedly different marine distributions with different vulnerabilities to ocean fisheries. Upriver spring stocks generally migrate offshore and are rarely retained in ocean salmon fisheries. As a result, they are not identified in Attachments I–V of the PST. Most summer and fall stocks have a northern distribution. Lower Columbia River tule fall Chinook salmon have a more l---al distribution and are caught mainly in the WCVI AABM fishery and US ISBM fisheries.

2.3.4.3.1 Columbia Upriver Spring

Escapement Methodology: To provide consistency with the *US v. Oregon* Technical Advisory Committee's annual Joint Staff's Reports, escapement graphs include the sum of wild adult upper Columbia spring Chinook salmon passing Rock Island Dam (Joint Columbia River Management Staff 2013, Table 8) and wild adult Snake River spring/summer Chinook salmon passing Lower Granite Dam (plus Tucannon escapements below; Joint Columbia River Management Staff, Table 9). However, for purposes of fishery management and allocation under *US v. Oregon*, Columbia Upriver spring stock includes all hatchery and wild fish destined to return past Bonneville from January 1 through June 15. There are additional tributary spawning escapements (e.g., Deschutes and John Day rivers) that comprise the Columbia Upriver spring management unit that are not included in the graph. Although it is not a completely comprehensive estimate of the naturally spawning Columbia Upriver spring

escapement past Bonneville, this times series provides a consistent and annually documented index of the abundance trend of naturally spawning fish (Figure 2.51).

Escapement Goal Basis: Under the 2008–2017 *US v. Oregon Management Agreement*, this stock is not managed for an escapement goal. Fishery impacts are managed using harvest rate schedules based on total river mouth abundance of upriver spring Chinook salmon or the Snake River natural spring/summer run size if it is less than 10% of the total run size (2008–2017 *US v. Oregon Management Agreement*, Appendix A, Table A1). The harvest rate schedule ranges from less than 5.5% at run sizes less than 27,000 up to 17% at run sizes exceeding 488,000.

Agency Comments: The 2008–2017 *US v. Oregon Management Agreement* provides for a minimum annual mainstem treaty Indian ceremonial and subsistence entitlement of 10,000 spring and summer Chinook salmon. Beginning in 2010, modifications to Table A1 (2008–2017 *US v. Oregon Management Agreement*) were implemented requiring Southern US nontreaty fisheries to meet catch balancing provisions for upriver spring Chinook salmon. Under these provisions, Southern US nontreaty fisheries are managed to remain within ESA impacts, and to not exceed the total allowable catch available for treaty Indian fisheries. Escapements in 2015 decreased from 35,411 to 26,782.

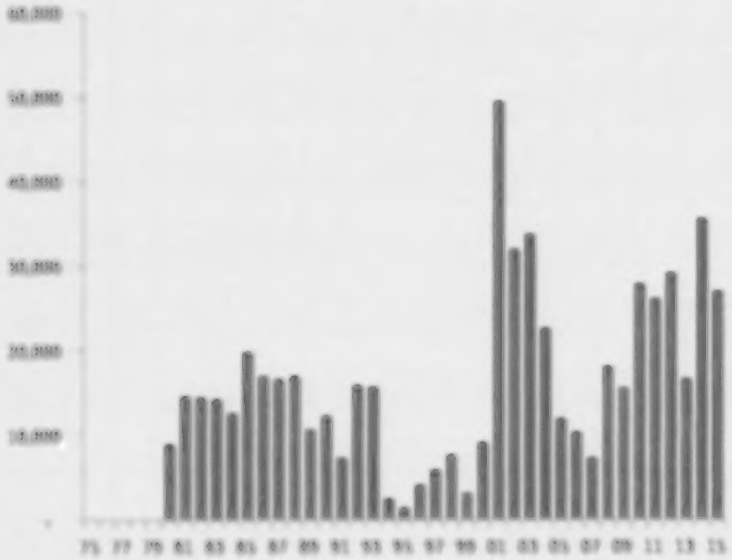


Figure 2.51.–Escapement of Columbia upriver spring Chinook salmon, 1980–2015.

2.3.4.3.2 Mid-Columbia Summer

Escapement Methodology: The Rock Island Dam count of adult Chinook salmon ascending between June 18 and August 17 are graphed in Figure 2.52; these counts include some hatchery fish, but are consistent with the combined hatchery and wild model data used to develop the interim escapement goal. The Rock Island Dam adult fish count during this period was 88,691 in 2015.

Escapement Goal Basis: The CTC (1999) developed an interim escapement goal of 12,143 adult summer Chinook salmon past Rock Island Dam, using PSC Chinook model predictions of escapement and recruitment. A 2008 analysis of actual escapement data resulted in a higher estimate, but the CTC requested the addition of more recent year's data, which has not been completed, so the interim goal remains.

Agency Comments: The summer management period is from June 16 to July 31. Catches of Chinook salmon during this period are in accord with a harvest rate schedule that varies based on expected river mouth abundance (2008–2017 *US v. Oregon Management Agreement*, Table A2). Harvest rates vary from about 5% to 7% for run sizes up to 16,000, 15% to 17% for run sizes up to 36,250, and are based on catch sharing formulas for harvestable surpluses beyond that run size. In addition, Mid-Columbia Summer Chinook salmon are managed for a goal of 29,000 hatchery- and natural-origin adults at the Columbia River mouth, to provide 20,000 adults above Priest Rapids Dam, including 13,500 Wenatchee/Entiat/Chelan natural fish, 3,500 Methow/Okanogan natural fish and 3,000 hatchery fish.

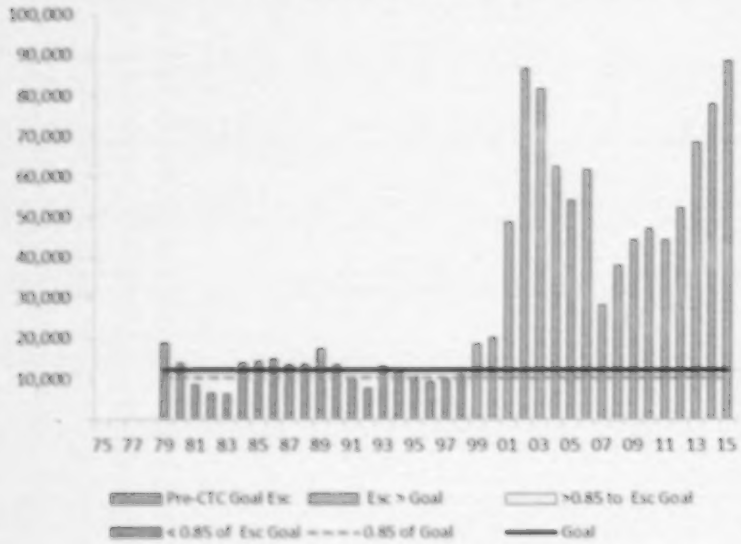


Figure 2.52.–Adult passage of Mid-Columbia Summer Chinook salmon at Rock Island Dam, 1979–2015.

2.3.4.3.3 Coweeman River Tules

The Coweeman River is a third-order tributary to the Cowlitz River located in Cowlitz County, Washington and drains approximately 329 km^2. This watershed supports a small population of mostly natural-origin age-3 and -4 tule fall Chinook salmon. The Coweeman escapement indicator stock represents ESA listed natural tule fall Chinook salmon production from the Lower Columbia River.

Escapement Methodology: From 2002 to 2011, Chinook escapement (>59 cm) for the entire basin was estimated through intensive PSC studies based on a variety of methods. For the years

with PSC studies, the escapements estimated from the PSC studies were on average 23% higher than the long-term estimates from expanding peak fish counts. The largest difference was in 2005 and 2007 where the PSC study escapement estimates were about double the estimate using other methods. The preferred method for estimating escapement in the Coweeman River is MR; physical MR was done from 2002 to 2004, and in 2011. In 2005 and 2006, live-count AUC estimates were produced using a trapezoidal AUC estimator and weekly counts of spawners in the index section; index AUC escapement was expanded to the entire spawning area based on the proportion of total spawners observed in the index reach during a basinwide survey near peak spawning time. In 2007 and 2008, redd-based escapement estimates were generated using a redd census, estimates of mean females per redd, and sex ratio. Genetic mark–recapture (GMR) was done in 2009 and 2010. Since 2011, escapement estimates have been made using a combination of physical MR method for fish above the weir and redd count expansion for fish spawning below the weir. Based on the results of the studies discussed above, a time series of expanded escapement estimates is now available on WDFW's SaSI inventory system. Further details for each year can be found online. The data graphed are total escapement estimates of naturally spawning fish (both natural and hatchery origin) expanded from red counts from the mouth of Mulholland Creek (RM 18.4) downstream to the Jeep Club Bridge (RM13.1) and was 1,430 Chinook in 2015 (Figure 2.53).

Escapement Goal Basis: The Coweeman stock has no CTC-accepted or agency escapement goal(s). It is managed according to an abundance-based exploitation rate ceiling schedule for Lower Columbia River Tule Chinook salmon under ESA fishery consultation standards.

Agency Comments: Coweeman Tule stock is listed as threatened under the US ESA. The agency recovery goal is 3,600 and a maximum recovery exploitation rate of 42%, with an interim minimum natural escapement goal of 1,000.

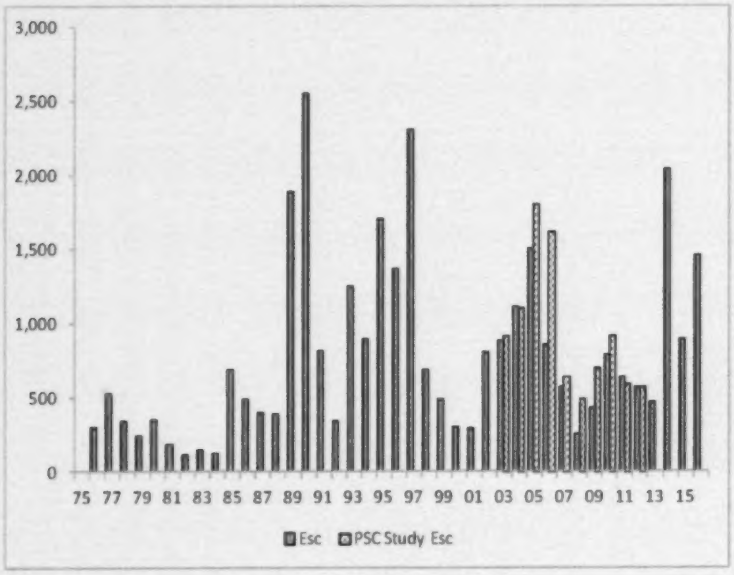


Figure 2.53.–Coweeman River escapements of tule fall Chinook salmon, 1975–2015.

2.3.4.3.4 Lewis River Fall

Escapement Methodology: Most natural bright fall Chinook salmon production below Bonneville Dam occurs in the North Fork Lewis River. The Lewis River Wild stock is the main component of the Lower River Wild management unit for fall Chinook salmon, which also includes small amounts of wild production from the Cowlitz and Sandy river basins. In this report, the escapements and goal are for the Lewis River component. Annual escapement estimates are obtained by expanding peak counts from weekly counts of live and dead fish in the 6.4 km area below Merwin Dam (river km 31.4) by a factor of 5.29 (total spawners per peak count). This factor was derived from a carcass tagging and recapture study performed in 1976 (McIsaac 1990). From 1999 to 2001, the expansion factor was verified. A CWT program for wild fish has been in place since 1977. Methods of CWT recovery, escapement counting, and expansion of the index area fish counts have been consistent since 1964. All naturally spawning adult fish, both hatchery and natural production, are included in the escapement. The total spawning escapement in 2015 was 23,631 Chinook salmon (Figure 2.54).

Escapement Goal Basis: The escapement goal of 5,700 fall Chinook in the Lewis River was developed by McIsaac (1990), based on spawner–recruit analysis of the 1964 to 1982 broods and CWT recoveries from the 1977 to 1979 broods. This analysis was updated by the CTC (1999) using brood years 1964 to 1991 and the goal of 5,700 was accepted as a biologically based goal.

Agency Comments: Lewis River escapements have been above their escapement goal since 1979, with the exception of 1999, and 2007–2009.

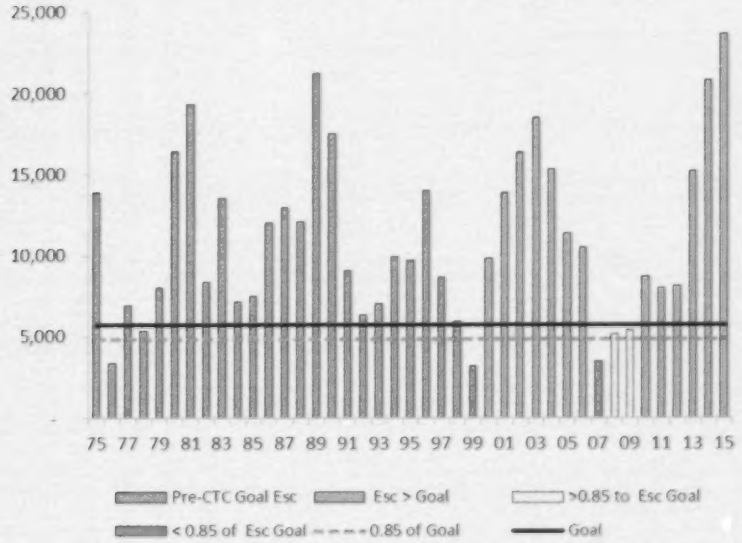


Figure 2.54.–Lewis River escapements of fall Chinook salmon, 1975–2015.

2.3.4.3.5 Deschutes River

Escapement Methodology: Escapement data are based on a MR estimate for the area above Sherars Falls and expanded for redd counts below Sherars Falls. From 2000 to 2007,

Confederated Tribes of the Warm Springs Reservation of Oregon performed an entire river MR experiment to validate the Deschutes River fall Chinook salmon escapement estimates. Results of these MR studies confirm the validity of the historical estimation methodology. For historic years when the entire river was not surveyed for redd counts, the time series was adjusted based on a comprehensive analysis done by Warm Springs, ODFW, and Columbia River Intertribal Fish Commission (CRITFC) staff.[2] See Figure 2.55 for Deschutes River escapements of fall Chinook salmon, 1977 to 2015, and Figure 2.55 for a comparison of the MR and traditional estimates. The estimated escapement in 2015 was 17,074 spawners.

Escapement Goal Basis: A CTC-accepted escapement goal of 4,532 adult fish was derived from the adjusted historical time series.[3]

Agency Comments: Deschutes River fall Chinook salmon escapements have been maintained above the goal since 1992.

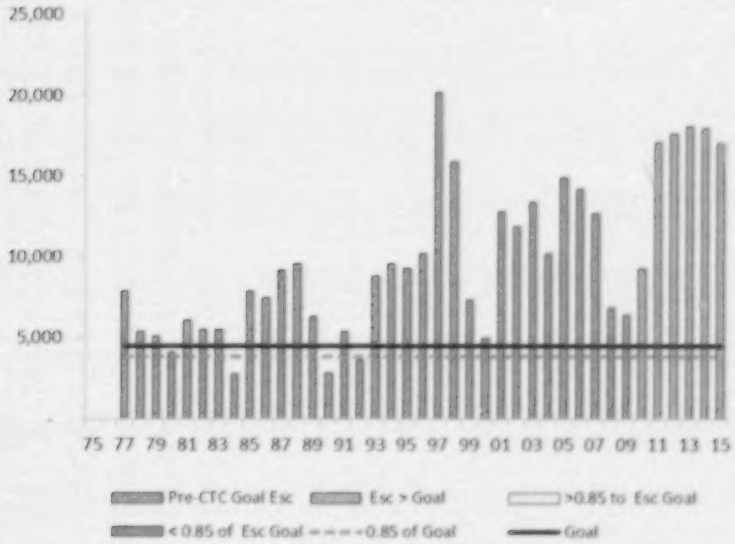


Figure 2.55.–Deschutes River escapements of fall Chinook salmon, 1977–2015.

[2] Sharma, R, J. Seals, J. Graham, E. Clemons, H. Yuen, M. McClure, K. Kostow, and S. Ellis. Unpublished. Deschutes River Chinook spawner escapement goal using US v. Oregon Technical Advisory Committee data.

[3] Ibid.

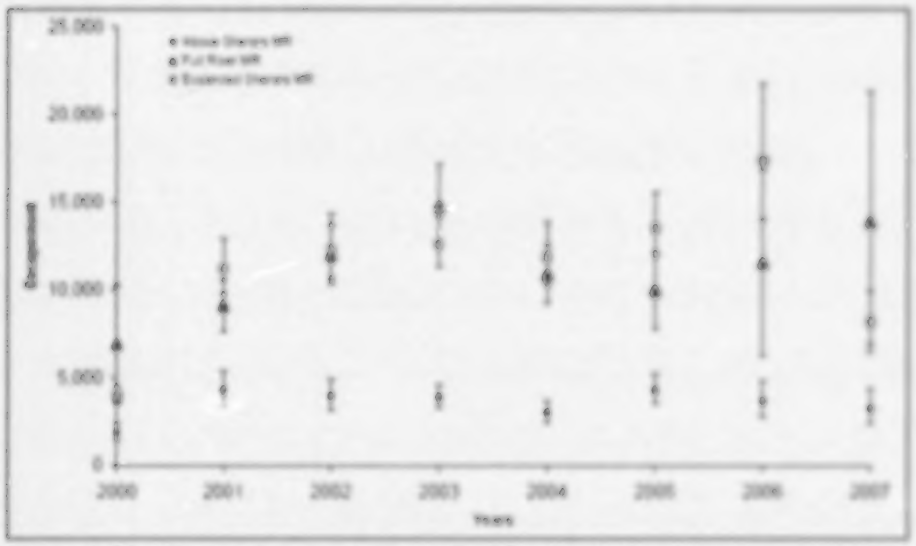


Figure 2.56.–The mark–recapture method for the entire river as compared to above Sherars Falls (ODFW method) expanded for redd ratios above and below the falls (with 90% CIs).

2.3.4.3.6 Columbia Upriver Brights

Escapement Methodology: Escapement estimates are calculated as the McNary Dam count minus Hanford Reach adult sport, Wanapum tribal catches, and brood stocks taken by Priest Rapids, Ringold and Snake River hatcheries.

Escapement Goal Basis: The CTC-agreed escapement goal for Columbia Upriver Bright Chinook salmon is 40,000 naturally spawning fish past McNary Dam based on stock–recruitment analyses.

Agency Comments: Under the 2008–2017 *US v. Oregon Management Agreement*, the minimum combined Columbia River and Snake River Upriver Bright management goal at McNary Dam is 60,000 adult fall Chinook salmon, which includes both hatchery and natural production for all areas above McNary Dam. The Parties also agreed to 43,500 as the minimum Upriver Bright escapement to meet the combined Hanford Reach, Lower Yakima River, and mainstem Columbia River above Priest Rapids Dam natural spawning goal, as well as the current Priest Rapids Hatchery production (this historically included a minimal run to the Snake River). Fall Chinook salmon fisheries are managed according to a harvest rate schedule ranging from 21.5% to 45%, depending on either (1) the expected river mouth run size of the aggregate fall Chinook salmon run, or (2) the Snake River natural-origin Chinook salmon run—if that run size is associated with a lower harvest rate. The primary management constraint on Columbia Upriver Bright production is the 15% harvest rate limit on commingled ESA listed summer steelhead (>78 cm) for forecast runs of less than 20,000. In some years, other constraints include ESA listed Snake River wild fall Chinook salmon impacts, and providing the escapement goal of 7,000 adults to Spring Creek Hatchery for tule fall Chinook salmon production. The 2015 escapement estimate was a record-breaking 388,999 adult Chinook salmon (Figure 2.57).

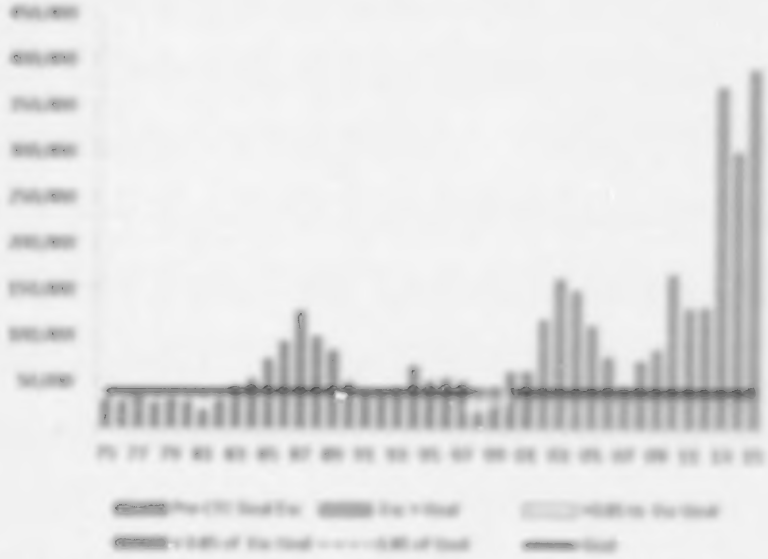


Figure 2.57.–Escapement of Columbia Upriver Bright Chinook salmon, 1875–2015.

2.3.4.4 Coastal Oregon

2.3.4.4.1 Oregon Coastal North Migrating

North migrating Chinook salmon originate from rivers in both the NOC and the MOC aggregates. Chinook salmon production in the NOC occurs mostly from naturally spawned, fall-returning, ocean-type life histories of fish. Adult spawning escapement is dominated by 4- and 5-year-old fish with smaller proportions of 3- and 6-year-old fish. Those Chinook salmon from the NOC aggregate stock are caught primarily in SEAK, NBC and in terminal fisheries.

Currently, only NOC fall Chinook salmon are accounted for in PSC management, while work is underway to include MOC stocks into the PST Chinook model. Stocks in the NOC aggregate are those salmon spawning from the Necanicum River in the north through the Siuslaw Basin in the south. Three escapement indicator stocks represent the production of NOC Chinook salmon: the Nehalem, Siletz, and Siuslaw stocks. Other stocks in the NOC aggregate include the Nestucca, Yaquina, Alsea, and Tillamook stocks. The Tillamook stock includes several substocks from the Kilchis, Miami, Trask, Tillamook and Wilson rivers.

Forecasts for the NOC aggregate are based on sibling regression relationships developed for each discrete stock, both indicator and nonindicator stocks. The aggregated forecast for the NOC is the sum of the forecasts for the individual basins within the geographic range. Forecasting methods were developed in 2008 and are continually refined with each year's additional information. Prior to 2008, the aggregate forecast (and each of the indicator stock's forecasts) was based on a running 3-year average.

2.3.6.6.1.1 Nehalem River

Escapement Methodology: Both historically conducted surveys which are expanded to represent available habitat (the normative agency methods) and MR based calibrations which utilize that same survey information were used to estimate escapement in the Nehalem during the 2013 return year. Standard estimates were generated from peak abundance observed during surveys of historically walked, standard index areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak count, and the bias observed between these predefined surveys and other survey areas that were randomly selected. Figure 2.58 represents escapement estimates generated using normative agency methodologies, which are directly comparable to the established escapement goal. Comparison between those standard estimates and MR estimates of adult spawning escapement funded by the PSC indicates that in most years (6 out of 8) standard agency escapement estimates fall within the CIs around the comparable MR point estimates for the Nehalem stock (Figure 2.59).

Escapement Goal Basis: The current point goal of 6,500 spawners was derived by Zhou and Williams (1999) and was based on assessments of escapement made through standard survey methodology.

Agency Comments: Methods of escapement estimation comparable to those used to generate the agreed to escapement goal for the Nehalem indicate a 2013 escapement of 12,679 adult spawners. This is 181% of the current escapement goal. After a period of decline between 2006 and 2010, the Nehalem stock has reestablished its traditionally observed high productivity and has met its escapement goal since 2011. Based on sibling regression forecasting methods, the Nehalem stock is forecasted to meet the escapement goal in 2016. ODFW is engaged in analysis to best use results from recent MR experiments to reconstruct historic estimates from peak counts observed in standard surveys and to apply those estimates towards the derivation of an updated escapement goal based on those escapement estimates.

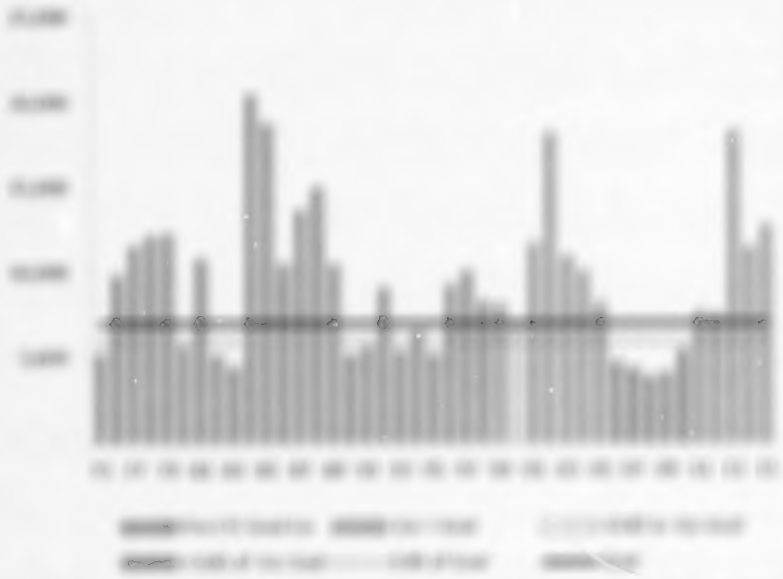


Figure 3.10. Kalinin River escapements of Chinook salmon, 1979–2015.

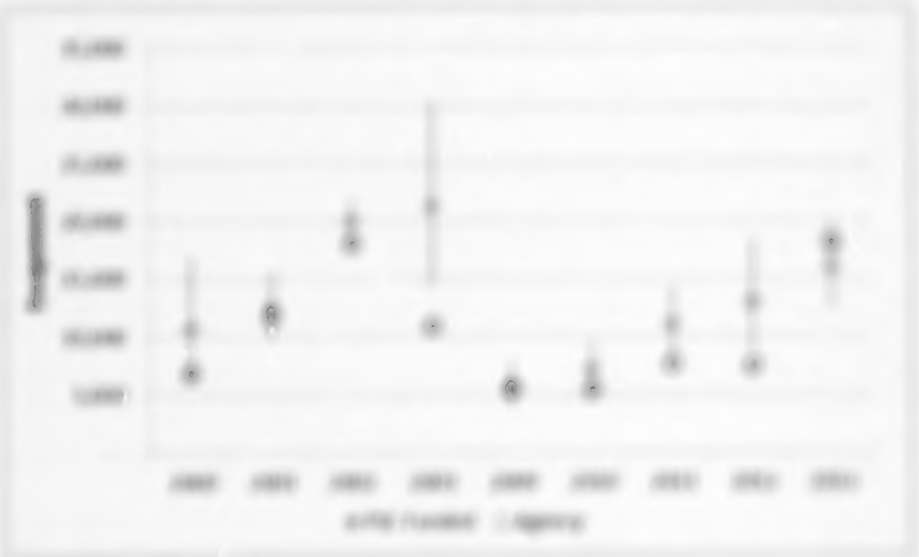


Figure 3.11. Kalinin River escapements of Chinook salmon in years when both agency historical expanded surveys were used (circles) and when mark-recapture estimates (diamonds) are point estimates and the bars are 95% CIs) were conducted with rates of agreement in SR funding from the PSF.

3.3.10.1.1.2 Wave Three Fall

Escapement Methodology. Standard estimates were generated from count observations obtained in nationally-certified, predefined areas of known passenger habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total not encountered during the count, and the bias was removed. These predefined surveys and other survey areas that are randomly selected. Escapement estimates generated using standard agency methodologies were used to develop the current escapement goal, and are presented in Table 3.3.10.1.1.2 in comparison with the goal (Figure 3.3.10.1.1.2).

Escapement Goal Review. The current point goal of 1,000 spawners is from Rice and Williams (2005) and was based on assessments of escapement made through standard survey methodology.

Comparison between standard estimates and estimates from MR double-tested by the NE reveals that for Wave MR based estimates with 10+ sea-than (MR), non-standard estimates are within the 2 around the MR based estimate. In 2008 the different estimates were nearly identical (Figure 3.3.10.1.1.2), and again in 2009, both estimates were quite similar.

Agency Comments. This stock has been studied with funds from the SF to improve escapement estimation using MR methods. However, inaccurate methods of escapement estimation remain in place until MR escapement based estimation and signal based on MR calibrated surveys is complete. The estimate derived from standard methods was 3,387 fish (Steward, pers. comm.) (108% of goal) in 2010. Following a period of failings to meet escapement goals between 1997 through 2006, this stock has met its escapement goal each year since 2010. This stock is forecasted to exceed its escapement goal in 2016.

Figure 3.3.10.1.1.2 Wave Three Fall escapements of Eshamy salmon, 1979–2010.

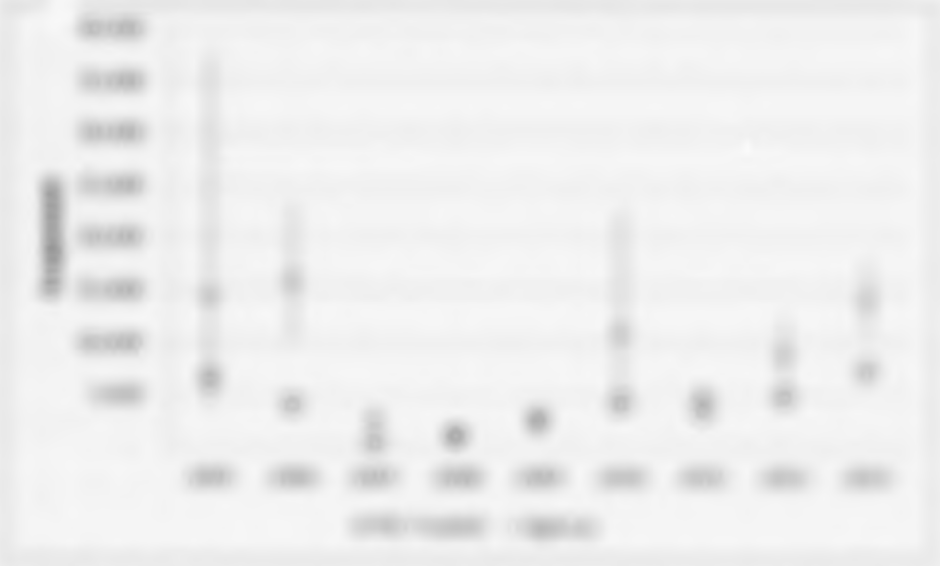


Figure 4.2b | Jobs-Work management all firmware without no used unless month agency increased assumed process were and monthly and other month employed estimates electricity our point estimates and file rate use 5000 for were evaluated with cable 4.2 Appendix 4.2. Will Footer Page 48 FY

4.2 FY2 4.2 Footer Page 108

Management Distributed Page. Historically conducted standard surveys and published estimates based on AMR collection failure in cases unfeed to measure management in file inches share monthly 2010. Standard estimates were generated from observations of grade discrepancies in five-inch traffic samples, predefined zones of known percentage batter (APC) file inches. These observations were then adjusted by estimates of file inch counters battery, estimated stored not data. File inch on unrecorded moving file pads, and file inches stored not transfer. These predefined zones and those file inch counters separate. These standard estimates were used to determine file current management grade and not used file management with field grade Figure 4.2b | Comparison of file standard agency management estimates with file inches AMR estimates based on field pattern with file standard estimates range considerably higher than file AMR estimates Figure 4.2b. Prior to file agency based estimate, AMR used to file commitment to percentage revisions of file management grade file. File Footer Page.

Management Field Data. The current current grade of 2,000 appeared was derived in 2000 by Pine and Williams. AMR cost was based on measurements of management made through standard survey methodology.

Agency Estimate. Discrepancies in AMR file. File Footer Page, estimated based on standard manual inspection methods, was 18,000 inch appeared. AMR based estimates were based estimates file. File return was unrecorded in estimate of 18,000 inch appeared. File current management grade estimate was based on file standard management estimate, as used to other

2.2.6.6.2 Wild Oregon Coast

Populations of the MOC have been proposed for inclusion in PSC management, and there are two proposed escapement indicator stocks, the South Umpqua and the Coquille stocks. This area is bounded by the Umpqua River on the north and the Elk River Basin on the south, and includes two additional major basins, the Coos and Coquille, and two small basins, Floras Creek and the Sixes River.

There is a mixture of natural and hatchery-produced salmon originating from the MOC, both of which return in the fall and follow an ocean-type life history. The largest age classes which normally contribute to spawning escapement are 4- and 5-year-old fish; however, there are smaller proportions of spawning escapement that are observed each return year that are 3- and 6-year-old fish. These Chinook salmon are caught primarily in SEAK, NBC, PFMC fisheries and in terminal fisheries.

Forecasts for MOC stocks, except for the Elk River stock, are based on sibling regression relationships developed for each discrete population in 2008 and updated with each year's additional information. Forecasts for the Elk River stock are based on projected survival rates of hatchery releases and recent proportions of wild adults in the aggregate return.

2.2.6.6.2.1 South Umpqua River Fall

Escapement Methodology: Aerial spawning surveys for fall Chinook salmon had been conducted by the ODFW on both the South Umpqua River and Cow Creek since 1978. Aerial spawning fish surveys were started as part of Douglas County's mitigation plan for the construction and operation of Galesville Dam on upper Cow Creek.

Citing safety concerns over the 2013 crash that injured two ODFW employees and the pilot, ODFW management mandated in 2014 that monitoring of Chinook salmon in the Umpqua river basin no longer include state employees in helicopters. Due to this mandate, techniques to estimate spawner escapement into the South Umpqua River have differed slightly since 2014 from that of previous years.

A visual index of abundance has since been developed as an alternative to aerial redd counts. A sum of dead index has been identified from two spawning ground surveys within the South Umpqua drainage as an alternative method to estimate abundance. Results from a calibration assessment of dead Chinook salmon to MR estimates indicated a strong correlation from two reaches in the basin. With this adaptation from aerial redd counts to a spawning ground index, the ability to relate back to the historical aerial redd counts would be lost, however the long-term redd count data has been related to known fish abundance through calibration to the MR studies.

Figure 2.66 shows South Umpqua River escapement of fall Chinook salmon, 1979–2015.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Recoveries of coded wire tagged fall run Chinook salmon from the Umpqua River indicate that they are caught in PST fisheries. The escapement estimate for 2015 was 17,322 adults based visual indices which are calibrated to estimates made during MR survey

years. There is some measure of unease in this estimate, in that it has been derived from observations outside the bounds of the correlated index, and it provides for an estimate well beyond the observed maximum in the time series.

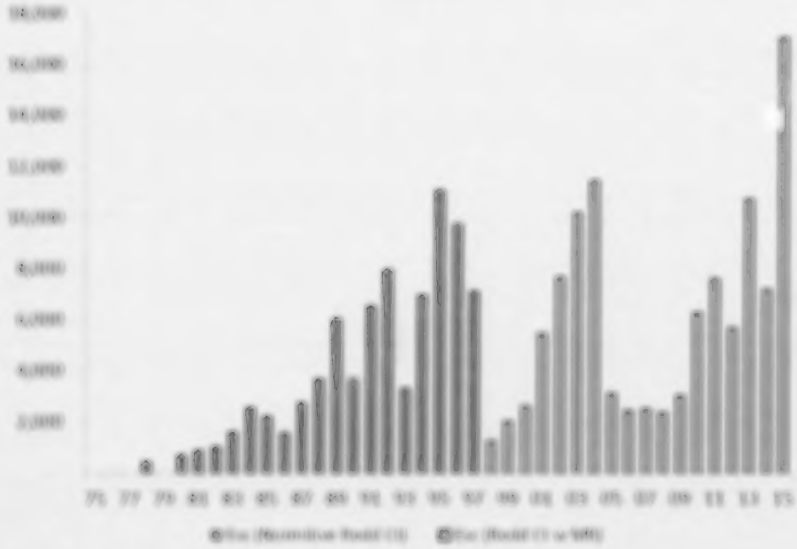


Figure 2.64.–South Umpqua River escapement of fall Chinook salmon, 1978–2015.

2.3.4.4.2.2 Coquille River Fall

Escapement Methodology: Both MR study based calibration factors (Figure 2.65) and historically conducted surveys were used to measure escapement during the past return year. Standard survey methods are identical to those described in the Siuslaw, Siletz and Nehalem basins. Values presented in Figure 2.65 are based on standard habitat survey estimations along with values calibrated to MR estimates. Both standard and MR calibrated estimates may be found in the appendix tables.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Methods based on MR-calibrated analysis yield an adult Chinook salmon escapement estimate of 15,782 for Coquille Basin spawners in 2015. The traditional habitat expansion-based estimate is 12,409 fish.

Improvements in applying those calibrated values towards the estimation of this and other Oregon Coastal stocks are currently being reviewed and discussed within the agency. It is anticipated that historical time series for each of the basins which have MR calibration studies (Nehalem, Nestucca, Siletz, Siuslaw, South Umpqua, Coos and Coquille rivers) will be updated in a subsequent reporting cycle.

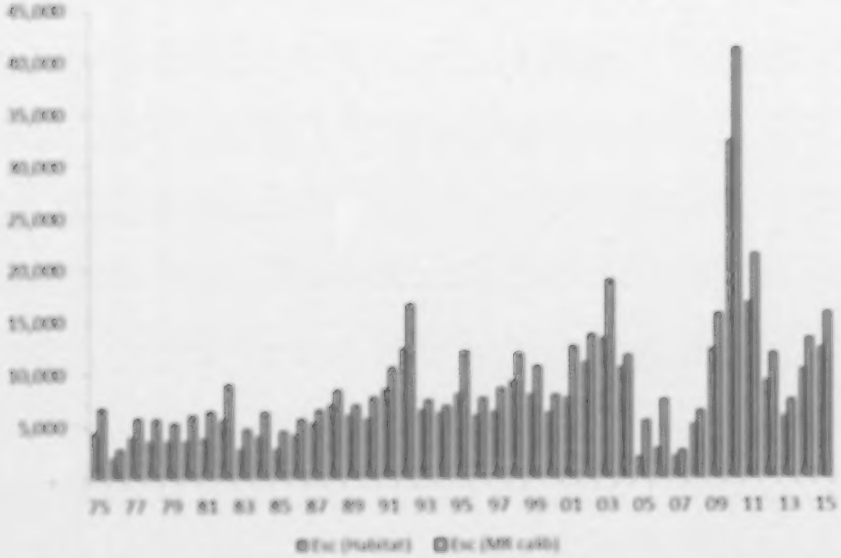


Figure 2.65.–Coquille River escapement of fall Chinook salmon, 1975–2015.

3. STOCK STATUS

3.1 SYNOPTIC EVALUATION OF STOCK STATUS

The following sections include graphics to display stock status information with spawning escapement on one axis and exploitation rate on the other. These synoptic plots display summary information for individual escapement indicator stocks. The figures present both the current status of stocks and the history of the stocks relative to PST management objectives. Information used in these figures includes (1) escapement data; (2) CTC-accepted MSY management objectives (or, in some cases, habitat model or agency stock–recruitment-based escapement objectives that have yet to be submitted to the CTC or agreed upon by the CTC); and (3) exploitation rates from related CWT indicator stocks to clearly summarize the performance of the stocks and fisheries management relative to established or potential goals.

The plots resemble those presented for groundfish in Garcia and De Leiva Moreno (2005). A general depiction of the plots with three reference lines is provided in Figure 3.1. The plots show the annual observations of a stock with regard to fishing rate (x-axis) and escapement abundance (y-axis) from one year to the next. There are three reference lines, one for fishing mortality (U_{MSY}) and two for escapement abundance (S_{MSY}, $0.85*S_{MSY}$) that define five zones on the plots. The definition of reference points for PST Chinook salmon stocks is based on the management objectives (escapement and exploitation rate) identified in the 2009 Agreement. The lower reference line for escapement on the synoptic plots is set at $0.85*S_{MSY}$ due to language in Paragraph 13 of the 2009 Agreement. For stocks with escapement objectives defined as ranges (SEAK, TBR, and the Harrison River), the lower reference line has been defined as 85% of the lower bound of the escapement range and the upper reference line has been set as the lower bound of the escapement range. The exploitation rate reference line (U_{SMSY}) is the exploitation rate at S_{MSY} for stocks with escapement objectives.

The three reference lines produce five zones in the synoptic plots. The green area (Safe Zone) in Figure 3.1 represents a healthy stock status where fishing is below U_{MSY} and the concurrent stock spawning abundance is above the specified escapement goal. The area of high risk (High Risk) is shaded red, and represents an area where a higher-than-prescribed fishing mortality is occurring concurrent with low escapement abundance. The two yellow zones (High Escapement High Exploitation, Low Escapement Low Exploitation) represent situations in which the stock could be in danger of falling into an area of conservation concern; in the upper right (High Escapement High Exploitation), escapement is at a healthy level, but fishing mortality is above the U_{MSY} limit, and in the lower left (Low Escapement Low Exploitation), fishing is occurring below the U_{MSY} limit but the population failed to attain a desired minimum escapement. The cross-hatched region is the PSC buffer zone, indicating problems may arise in the future.

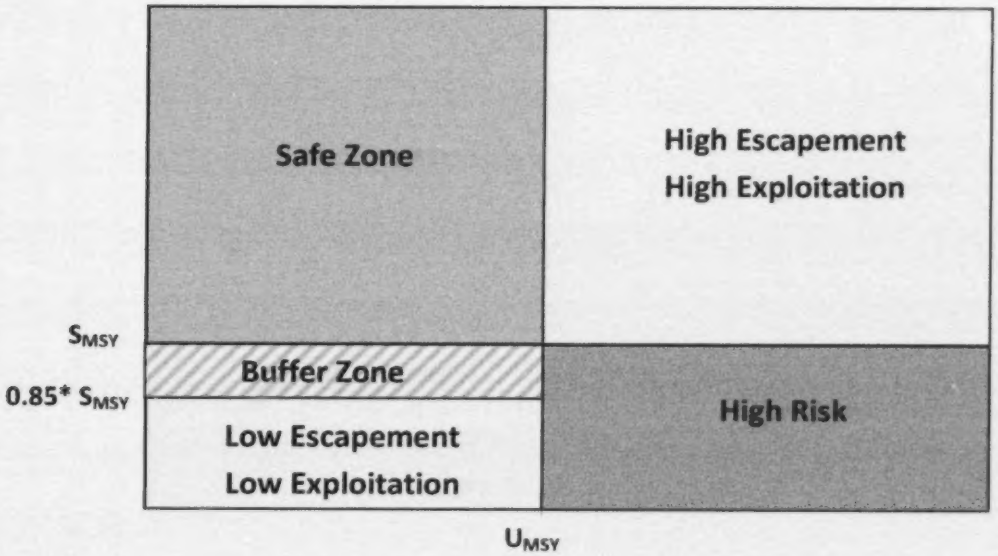


Figure 3.1.–Precautionary plot for synoptic evaluations of PST Chinook salmon stocks.

Exploitation rates used in the synoptic plots are one of the following: CY exploitation rates, preterminal cumulative mature-run equivalent (MRE) exploitation rates, or total (preterminal and terminal) cumulative MRE exploitation rates. Total cumulative MRE exploitation rates cannot be used when there is a terminal fishery that is directed on the hatchery indicator stock because the terminal exploitation will differ from that on the wild stock being represented. The ages used in the escapement and exploitation rate calculations are not the same for each stock presented in the synoptic charts below, and typically exclude age 2 for ocean-type stocks and age 3 for stream-type stocks. See Table 3.1 for more detail.

Calendar year exploitation rates are computed as

$$CYER_{CY} = \frac{OceanMorts_{CY} + TermMorts_{CY}}{(OceanMorts_{CY} + TermMorts_{CY} + OESC_{CY})}$$

Cumulative MRE exploitation rates are computed as

$$CMREER_{CY} = 1 - \left(\frac{OESC_{CY}}{PESC_{CY}}\right)$$

where

$$OESC_{CY} = \sum_{a=startage}^{maxage} OESC_{CY,a},$$

$$PESC_{CY} = \sum_{a=startage}^{maxage} PESC_{CY,a},$$

and

$$PESC_{CY,a} = \frac{OESC_{CY,a}}{CumSurvRte_{CY-a,a}}.$$

When computing total (preterminal and terminal) MRE exploitation rates, the cumulative survival rate is computed for each age in a brood year as

$$CumSurvRte_{BY,a} = TermSurvRte_{BY,a} * \prod_{i=startage}^{a} PreTermSurvRte_{BY,i}.$$

When computing preterminal MRE exploitation rates the cumulative survival rate is computed for each age in a brood year as

$$CumSurvRte_{BY,a} = \prod_{i=startage}^{a} PreTermSurvRte_{BY,i}.$$

The preterminal harvest rates for each age in a brood year are computed as

$$PreTermHR_{BY,a} = \frac{OceanMorts_{BY,a}}{CohortSizeANM_{BY,a}}.$$

The preterminal survival rates for each age in a brood year are computed as

$$PreTermSurvRte_{BY,a} = 1 - PreTermHR_{BY,a}.$$

Table 3.1.–Parameter definitions for all equations used to estimate CY exploitation rates and cumulative mature-run exploitation rates.

Parameter	Description
$a =$	age
$BY =$	Brood year
$CY =$	Calendar year
$CMREER_{CY} =$	Cumulative MRE exploitation rate for calendar year *CY*
$CohortSizeANM_{BY,a} =$	Cohort size after natural mortality for brood year *BY* and age *a*
$CumSurvRte_{BY,a} =$	Cumulative survival rate for brood year *BY* and age *a*
$CYER_{CY} =$	Calendar year exploitation rate for calendar year *CY*
$OceanMorts_{BY,a} =$	Ocean mortalities for brood year *BY* and age *a*
$OESC_{CY} =$	Observed escapement for calendar year *CY*
$OESC_{CY,a} =$	Observed escapement for calendar year *CY* and age *a*
$PESC_{CY} =$	Potential escapement for calendar year *CY*
$PESC_{CY,a} =$	Potential escapement for calendar year *CY* and age *a*
$PreTermHR_{BY,a}=$	Pre-terminal harvest rate for brood year *BY* and age *a*
$PreTermSurvRte_{BY,a} =$	Pre-terminal survival rate for brood year *BY* and age *a*
$TermMorts_{CY} =$	Terminal mortalities for calendar year *CY*
$TermSurvRte_{BY,a} =$	Terminal survival rate for brood year *BY* and age *a*

Data necessary to plot the stock trajectories are available for most escapement indicator stocks (Table 3.2). Most escapement indicator stocks have companion exploitation rate indicator stocks that are assumed capable of reflecting the exploitation rates in preterminal areas. With suitable assumptions about terminal area fisheries, the total exploitation rates on stocks can be estimated. Most areas along the coast have escapement indicator stocks. Notable exceptions are the UGS area, the WCVI area and the Fraser River early stocks (spring and summer). For UGS, the CTC in the past has reported escapement for an aggregate. In future catch and escapement reports, the CTC will provide the individual metrics in addition to the aggregate numbers. The Fraser early stock consists of additional complexities for escapement indicator stocks, which are delineated on the basis of life history, and the stocks listed in Attachments I, II, and IV, which are based on geography. Region-specific synoptic evaluations of Chinook salmon stocks are presented in Section 3.2.

Table 3.2.–Summary of information available for synoptic stock evaluations.

Region[1]	Escapement Indicator	S_{MSY}	85% of S_{MSY}[2]	Exploitation Rate Indicator	U_{MSY}	Type of Exp. Rate[3]
SEAK	Situk	600	425	Situk wild	0.81	CY
SEAK	Chilkat	2,200	1,488	Chilkat wild	0.40	CY
SEAK	Unuk	2,764	1,530	Unuk wild	0.60	CY
SEAK	Chickamin (survey index)	525	383	Alaska Hatchery (Neets, Whitman, Deer) and Unuk wild	0.72	CMRE
TBR	Alsek	4,677	2,975	Alsek wild	0.58	CY
TBR	Taku	25,500	16,150	Taku wild	0.59	CY
TBR	Stikine	17,400	11,900	Stikine wild	0.42	CY
BC	Harrison	75,072	63,811	Chilliwack	0.57	CMRE
BC	Cowichan	6,514	5,537	Cowichan	0.69	CMRE
BC	Kitsumkalum	8,621	7,328	Kitsumkalum	0.61	CMRE
BC	Atnarko	5,009	4,258	Atnarko	0.77	CMRE
BC	Nicola	8,337	7,086	Nicola	0.59	CMRE
BC	Lower Shuswap	12,339	10,488	Lower Shuswap	0.73	CMRE
COLR	Columbia Upriver Summer	12,143	10,322	Columbia Summers	0.75	CMRE
COLR	Columbia Upriver Brights	40,000	34,000	Upriver Brights	0.56	CMRE
COLR	Deschutes River Fall	4,532	3,852	Lewis River Wild	0.79	CMRE
COLR	Lewis River Fall	5,791	4,922	Lewis River Wild	0.79	CMRE
WAC	Quillayute Fall	3,000	2,550	NA		NA
WAC	Queets Spring/Summer	700	595	NA		NA
WAC	Queets Fall	3,000	2,550	Queets Fall Fingerlings	0.74	CMRE
WAC	Hoh Spring/Summer	900	765	NA		NA
WAC	Hoh Fall	1,200	1,020	NA		NA
ORC	Nehalem	6,989	5,941	Salmon River	0.69	CMRE
ORC	Siletz	2,944	2,502	Salmon River	0.81	CMRE
ORC	Siuslaw	12,925	10,986	Salmon River	0.61	CMRE

[1] See List of Acronyms for definitions.

[2] Stocks with an escapement goal range use 85% of the lower bound.

[3] Two types of exploitation rates were used: cumulative mature-run equivalents (CMRE) and calendar year (CY) which are based off of actual stock assessment data gathered annually for each stock.

A synoptic summary figure for 23 stocks with 2014 data shows that the majority of stocks were in the safe zone (Figure 3.2). No stocks were in the high-risk zone and two stocks (Cowichan and

Harrison) were in the low escapement and low exploitation zone. Two stocks (Columbia Summers and Columbia Upriver Brights) experienced exploitation near U_{MSY} and still the escapement exceeded S_{MSY} by nearly 6-fold. The Southeast Alaska, Transboundary River, and Washington and Oregon coastal stocks clustered closer to the 1.0 index lines than the other regional groups. In general, Columbia River stocks showed a higher escapement to S_{MSY} index than the other regions where there was no pattern.

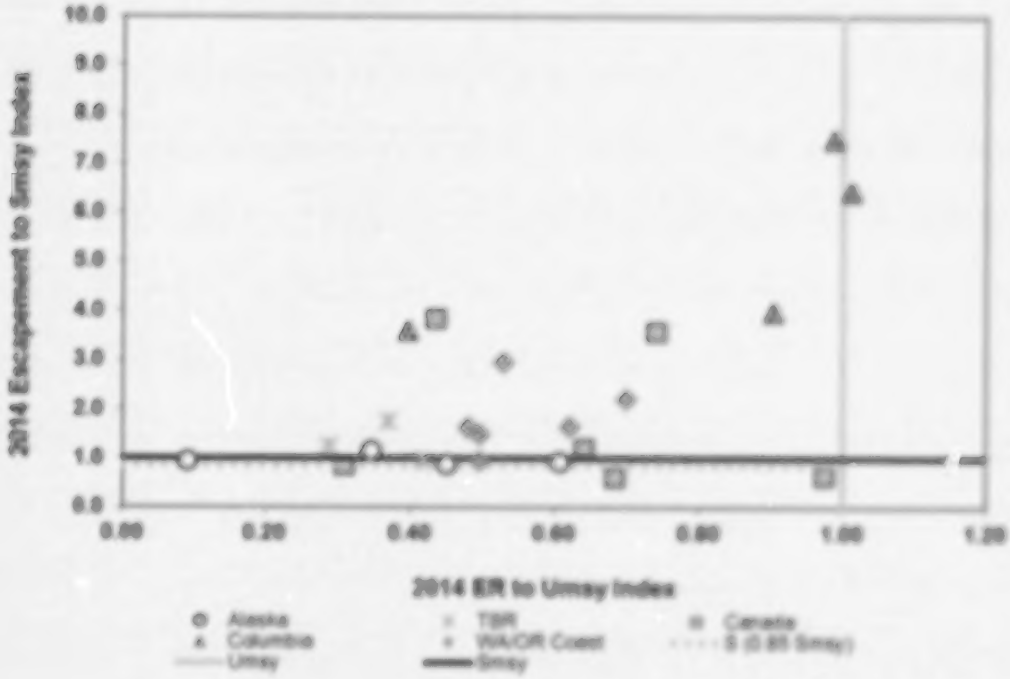


Figure 3.2.–A synoptic summary by region of stock status for stocks with escapement and exploitation rate data in 2014.

Note: Escapement and exploitation rate data were standardized to the stock-specific escapement goal and U_{MSY} reference points.

3.2 Regional Trends and Profiles

3.2.1 Southeast Alaska Stock Status: Situk, Chilkat, Unuk, and Chickamin Rivers Chinook Salmon

Recent declines in Chinook salmon productivity and abundance are widespread and persistent throughout Alaska, particularly in western and northern Alaska. Available run abundance data for Chinook salmon in Alaska indicate significant declines were first fully detected in 2007—as expected—from a persistent decline in productivity that began with returns from brood year 2001. Run abundance data available from 21 stocks in Alaska show substantial variability and

moderate to no coherence among stocks prior to 2004 (Figure 3.3). This is consistent with downward trends in productivity and similar declines of SEAK Chinook salmon stocks.

The SEAK stocks have two main rearing behaviors that are consistent and predictable. Outside-rearing behavior includes rearing in the Gulf of Alaska and Bering Sea after leaving the freshwater environment. Inside-rearing behavior involves rearing in the nearshore environment of SEAK. Outside-rearing stocks include the Situk River stock, and the transboundary Alsek, Taku, and Stikine stocks; the majority of these fish strictly adhere to this behavior. Inside-rearing stocks include the Chilkat, Unuk, and Chickamin stocks, and although the vast majority rear in the nearshore environment, CWT information suggests at least a small proportion of these fish exhibit outside-rearing behavior. Productivity has decreased for both outside- and inside-rearing stocks; the decline is far reaching, extends beyond SEAK, and has affected most Alaska Chinook stocks.

Figure 3.3 – Average of standardized deviations from average run abundance for 21 stocks of Chinook salmon in Alaska (the Unalakleet, Nushagak, Goodnews and Kuskokwim in western Alaska; the Chena and Salcha on the Yukon River; the Canadian Yukon, the Chignik and Nelson on the Alaska Peninsula; the Karluk and Ayakulik on Kodiak Island; the Deshka, Anchor and late run Kenai in Cook Inlet, the Copper in the northeastern Gulf of Alaska, and the Situk, Alsek, Chilkat, Taku, Stikine, and Unuk in Southeastern Alaska).

The Situk River stock has failed to meet the escapement goal five times since 2005. Over the recent decade, this stock has demonstrated the poorest performance among the four SEAK stocks. This failure cannot be attributed to fishery impacts alone, which are among the lowest in the region. Because harvests are mostly inriver or in the estuary, detailed catch accounting programs enumerate the vast majority of the harvest, which produces CY harvest estimates. Because this stock is outside rearing, it is not exposed to SEAK harvest before maturation. Calendar year exploitation rates for the Situk stock have been below—and have never

exceeded—the U_{MSY} threshold of 51%. During the recent seven years of poor escapements for Situk River Chinook, exploitation rates have averaged 22%, including a low rate of 9% in 2011 when estimated escapement was 48% of the goal. Overall, rates exerted on the Situk River stock have never approached the U_{MSY} rate (51%) and were 10% in 2013 (Figure 3.4). The poor runs and escapement primarily result from decreased productivity, and mirror the very low productivity of other Alaska stocks that rear in the Gulf of Alaska and Bering Sea. Management measures have been in place for the Situk stock to reduce harvests and increase escapement. Even with very restrictive management actions, however, the escapement goal for the Situk River stock will be difficult to attain until productivity improves.

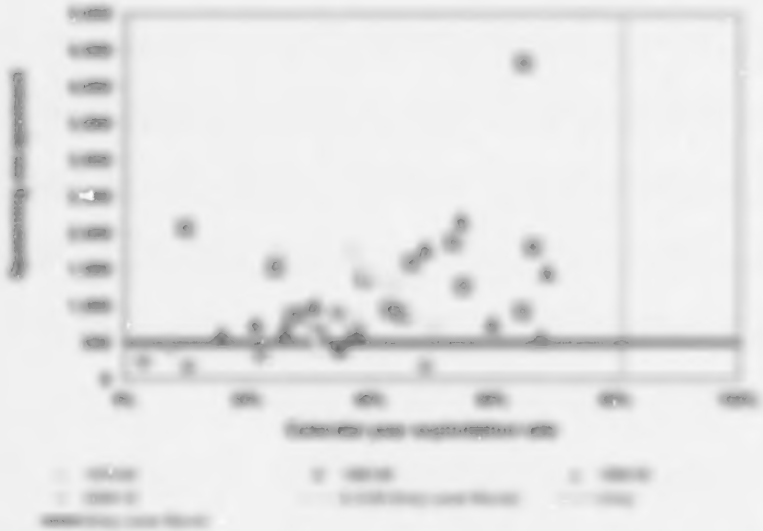


Figure 3.4.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for the Situk River stock of Chinook salmon, 1979–2013.

Chilkat River Chinook salmon return to northern SEAK and are mostly ocean rearing. The Chilkat River stock failed to achieve the escapement goal three times since 2005. The Chilkat River is located at the northern end of Lynn Canal, gillnet and sport fisheries in the region can be managed to conserve the Chilkat River stock of Chinook.

A successful CWT program is in place to estimate harvest of the Chilkat River Chinook salmon. CWT recovery data indicates some age-4 Chilkat River Chinook salmon are harvested while rearing in SEAK, primarily in net fisheries. However, the majority of harvest is of mature fish from sport, commercial troll, and drift gillnet fisheries in SEAK. In general, exploitation rates on the Chilkat River stock of Chinook salmon are some of the lowest observed for Chinook salmon stocks, with a recent 10-year average exploitation rate of 16%, well below the threshold reference value of 40% (Figure 3.5).

Chinook smolt abundance and survival have been estimated for the Chilkat River stock since the 1998 brood year. Freshwater survival has, for the most part, been about average with the

exception of the 2006 and 2007 brood years. Marine survival was above average for brood years 1998 to 2001 and below average or about average for the more recent broods (Figure 5.6). Below average productivity has significantly affected abundance in the Chilkat River and continued low exploitation rates will be needed to achieve the escapement goal until productivity improves.

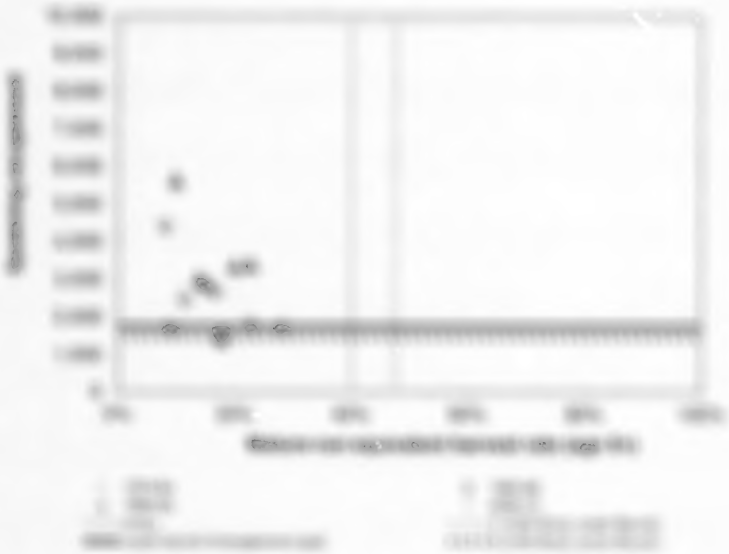


Figure 5.5. Cohoster fear exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for the Chilkat River stock of Chinook salmon, 2003–2015.

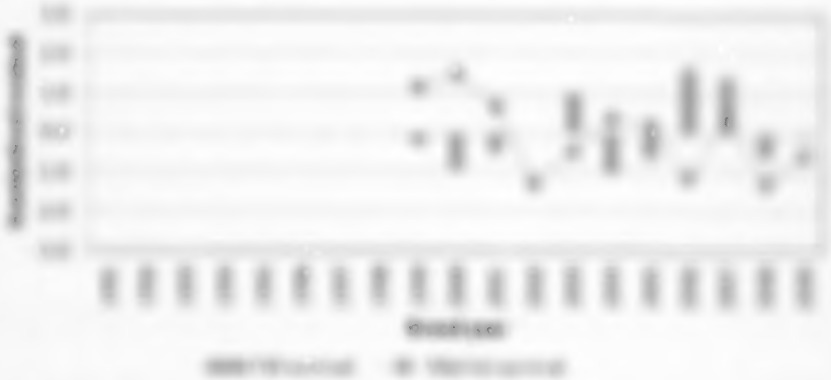
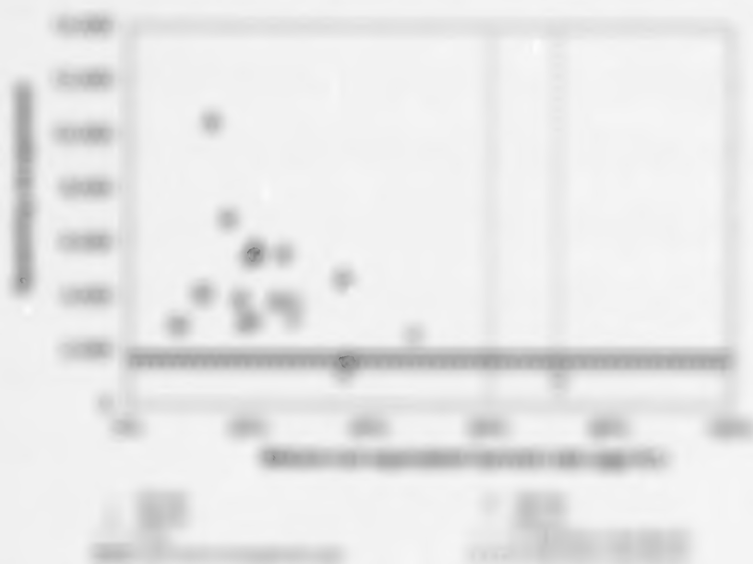


Figure 5.6. Freshwater and marine survival indices (standardized to a mean of zero) for the Chilkat River stock of Chinook salmon, 1998–2008 brood years.

The Chuk and Chickamin rivers flow into Ratton Canal in southern SEAK and Chinook salmon from these rivers are mostly made-rearing stocks. Since 2006, the Chuk River stock had below goal escapement estimates from 2012 to 2014 and the Chickamin River stock was below the



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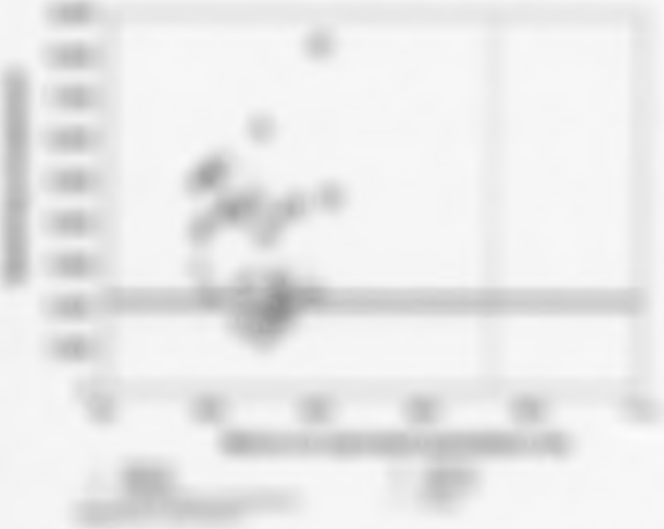


Figure 6.3.1: Effect of min_samples_leaf on cross-validation accuracy. Mean accuracy (solid line) and 95% confidence intervals (shaded band) plotted against min_samples_leaf. Vertical dashed line marks the optimal value (min_samples_leaf = 18). Accuracy peaks at 0.91 and remains stable across a wide range, indicating robustness to this parameter.

6.3.2.2 Transfer Learning: Pre-train on Source Domain, Fine-tune on Target Domain

Transfer learning allows a model trained on one domain to be adapted to a related domain with limited data. In this study, we pre-train a model on a large synthetic dataset (50,000 samples, generated from a multivariate Gaussian with 20 features and 5 classes) and then fine-tune it on the real target dataset (2,400 samples). The hypothesis is that the model learns general feature representations from the synthetic data that are useful for the real classification task, even though the synthetic data does not perfectly match the real distribution.

Fine-tuning proceeds in two stages: first, the output layer is trained while the hidden layers are frozen; second, all layers are unfrozen and trained with a reduced learning rate (0.001 vs. 0.01 for the initial training). This prevents catastrophic forgetting of the pre-trained representations while allowing the model to adapt to the target domain. Early stopping with patience 10 is applied to both stages.

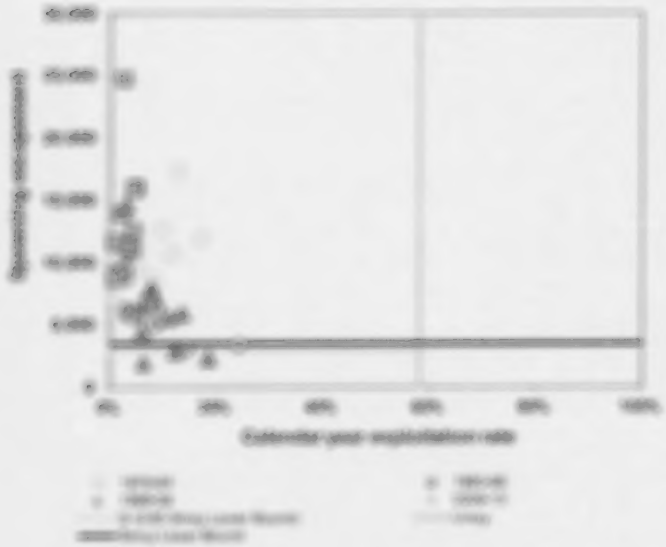


Figure 3.10 – Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for the Atbek River stock of Chinook salmon, 1976–2012.

The Taku and Stikine river stocks have also demonstrated reduced productivity recently. Preseason forecasts are developed for each of these stocks by December 1 per PST obligations specified in Chapter 1. The preseason forecasts trigger directed Chinook salmon fisheries in the US and Canada during years of surplus production, and inseason estimates are used to refine fishery management. In recent years forecasts have overestimated the run size, and to account for this forecasts have been adjusted by the five-year average percentage error and this method has performed well. Despite reduced productivity, escapement goals have been achieved for both stocks in all but one year since 2009.

In years of surplus production, exploitation rates increase accordingly. For the Stikine River stock this has resulted in the threshold reference value being exceeded three times since directed fisheries were developed in 2005; however, escapement goals were achieved in those three years. These stocks rear in the Gulf of Alaska and Bering Sea and as a result are minimally exposed to SEAK fisheries as immature fish; primary harvest on these stocks is on mature adults.

Between 1976 and 2004 commercial fishing for these two stocks in the terminal area was closed or severely restricted. These two stocks are harvested in local marine sport fisheries and incidentally in US and Canadian traditional sockeye salmon gillnet fisheries that take place near the end of each Chinook salmon run. Both stocks are also caught outside of the terminal districts in commercial spring troll fisheries, and to some extent, in outside sport and net fisheries. Regardless, most harvest takes place inriver and in the terminal districts, and detailed genetic stock identification programs are in place to identify Taku and Stikine Chinook from other stocks in the mixed stock marine waters. This program, when coupled with the

assessment methods described in McPherson et al. (2010) for CYs 1977–2007 for the Taku River stock and in Bernard et al. (2000) for CYs 1981–1997 for the Stikine River stock, has been used to provide CY harvest estimates since 2005. Exploitation rates since 2009 for the Taku River stock averaged 24%; the escapement goal was missed in 2013. From 1975 to 2015, however, the CY exploitation rate on the Taku River Chinook salmon stock averaged 16%, well below the U_{MSY} threshold of 59% (Figure 3.11).

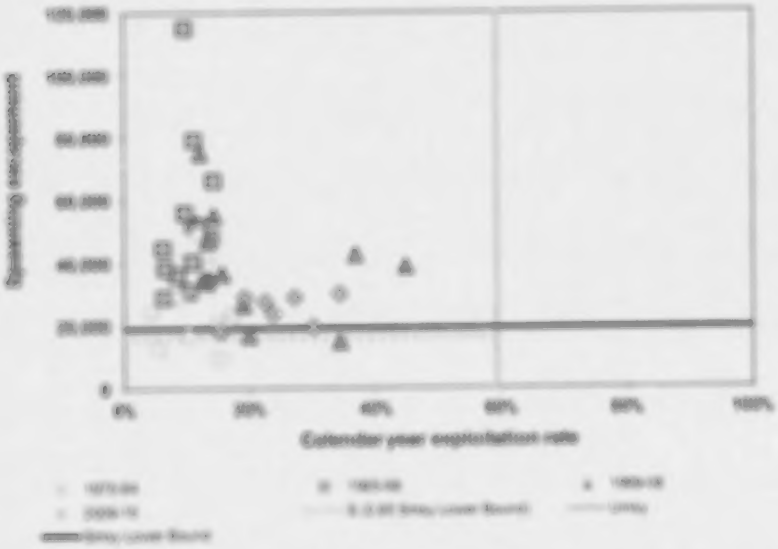


Figure 3.11.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for the Taku River stock of Chinook salmon, 1975–2015.

Exploitation rates since 2009 for the Stikine River stock averaged 19% and the escapement goal was not met in 2009. Substantial directed fishing took place from 2005 to 2008 and exploitation rates averaged 47% which is over the threshold value; however, the escapement goal was achieved annually during this time period. From 1975 to 2015 the exploitation rate on Stikine River Chinook salmon stock averaged 23%, well below the threshold value (Figure 3.12).

Until the low productivity regime associated with stocks that rear in the Gulf of Alaska and Bering Sea improves, exploitation rates on Alsek, Taku, and Stikine river stocks will need to remain low; regardless, escapement goals may not always be achieved due to poor marine survival.

Chinook salmon smolt abundance and survival has been estimated for the Taku River stock since the 1992 brood year. The data suggest that freshwater survival has been above average in recent years; however, marine survival has undergone cycles throughout this period and the most recent nine brood years have been below average (Figure 3.13).

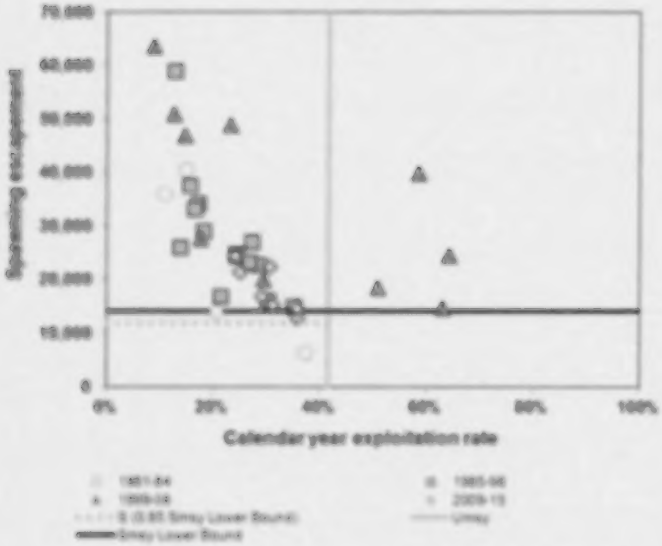


Figure 3.12.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for the Stikine River stock of Chinook salmon, 1981–2015.

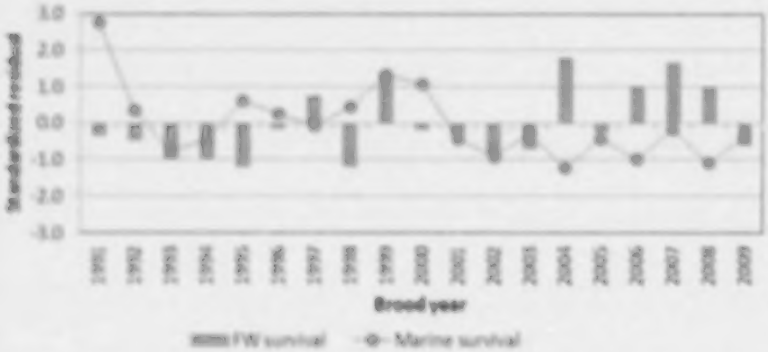


Figure 3.13.–Freshwater and marine survival indices (standardized to a mean of zero) for the Taku River stock of Chinook salmon, 1992–2009 brood years.

Smolt abundance and survival have been estimated for the Stikine River stock of Chinook salmon since the 1998 brood year. No trends are apparent in freshwater survival estimates; however similar to Taku Chinook salmon, marine survival has been below average for the most recent brood years (Figure 3.14).

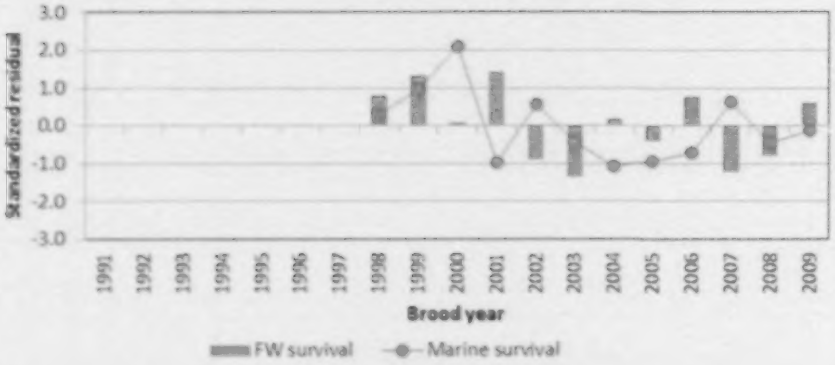


Figure 3.14.–Freshwater and marine survival indices (standardized to a mean of zero) for the Stikine River stock of Chinook salmon, 1998–2009 brood years.

3.2.3 Canadian Stocks

3.2.3.1 Northern British Columbia: Kitsumkalum River

The North/Central BC model stock group includes the Yakoun, Nass, and Skeena escapement indicators in Northern BC. Currently, none of these indicator stocks have CTC-agreed escapement goals. The exploitation rate indicator stock for the North/Central model stock group is the Kitsumkalum in the Lower Skeena River; high quality MR escapement estimates have been produced for this stock annually since 1984. This stock has had a very low level of enhancement relative to the CWT indicator stock targets (mean enhanced contribution = 3.4%, range = 0.4–9.4%, run years 1985–2012). McNicol (1999) reviewed these data and estimated the stock–recruit relationship, which was updated by Parken et al. (2006). Marine survival has fluctuated up to brood year 2006, and since brood year 2007 has been below average (Figure 3.15). The mature-run equivalent exploitation rates have been below the threshold reference line in all years (Figure 3.16). Spawning escapements have exceeded S_{MSY} reference line in all years but three. In the earliest period (1989–1998), there were two years in which the stock with the spawning escapement was in the buffer zone and one of the years the stock was in the low escapement and low exploitation zone. Recently (1999–2015), the stock has been in the safe zone.

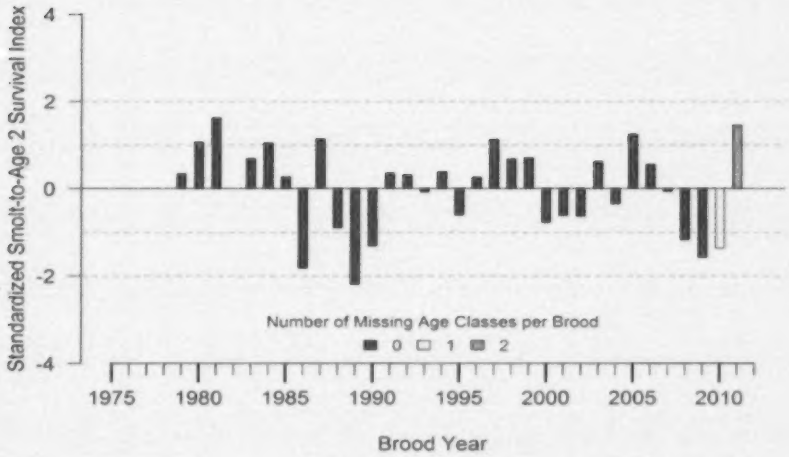


Figure 3.15.–Marine survival index (standardized to a mean of zero) for the Kitsumkalum River stock of Chinook salmon, 1979–2011 brood years.

Note: Brood year 1982 was not represented by CWTs; thus no datum is available.

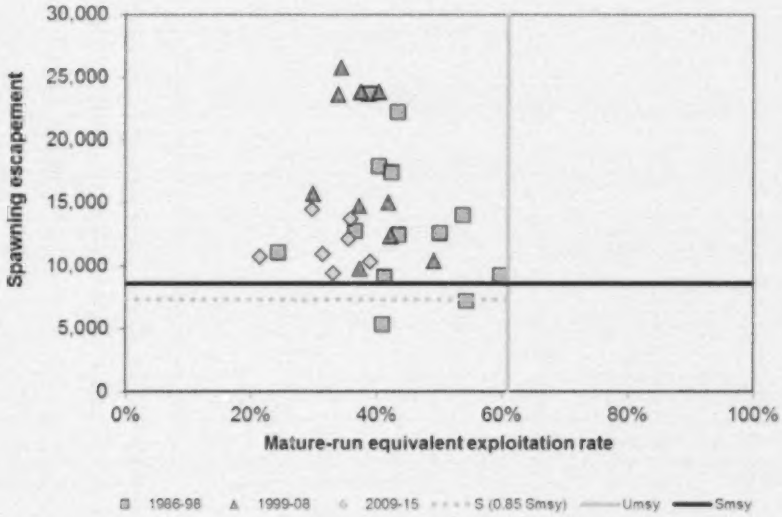


Figure 3.16.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Kitsumkalum River stock of Chinook salmon, 1985–2015.

3.2.3.2 Central British Columbia: Atnarko River

The North/Central BC model stock group includes the Dean and Atnarko escapement indicators in Central BC. Currently, none of these indicator stocks have CTC-agreed escapement goals. The Atnarko River was added as an exploitation rate indicator stock in Area 8 in 2012 (Vélez-Espino et al. 2011) with MR escapement estimates produced annually (Vélez-Espino et al. 2010). These estimates were used to calibrate the time series of existing carcass count based escapement

estimates and broodstock CPUE back to 1990 (Vélez-Espino et al. 2014). This stock has had a moderate level of enhancement relative to the CWT indicator stock targets (mean enhanced contribution = 35%, range = 13–67%, run years 1990–2015).

The largest hatchery contributions occurred in the mid-1990s, reaching 67% in 1996, whereas the lowest (13%) took place in 2008. Recent increases in hatchery contribution are partly due to the implementation of yearling releases in addition to the subyearling releases. Adjustments have been made to escapement estimates to remove hatchery fish in order to make inferences for unenhanced stocks in Central British Columbia (Vélez-Espino et al. 2014). A stock–recruitment relationship has not yet been generated; however, a habitat-based estimate of S_{MSY} (Parken et al. 2006) of 5,009 large adults has been developed for Atnarko Chinook salmon (Vélez-Espino et al. 2014).

The average marine survival (i.e., age-2 cohort survival) of Atnarko Chinook salmon is 2.4% (for brood years 1986–2011), with an increasing tendency from brood year 1986 to brood year 1991, and remaining generally below average from brood year 1992 up to brood year 2009. For brood year 2010, marine survival increased to a level comparable to that achieved for brood year 1990 and reached the highest recorded level (5.5%) for brood year 2011 (Figure 3.17).

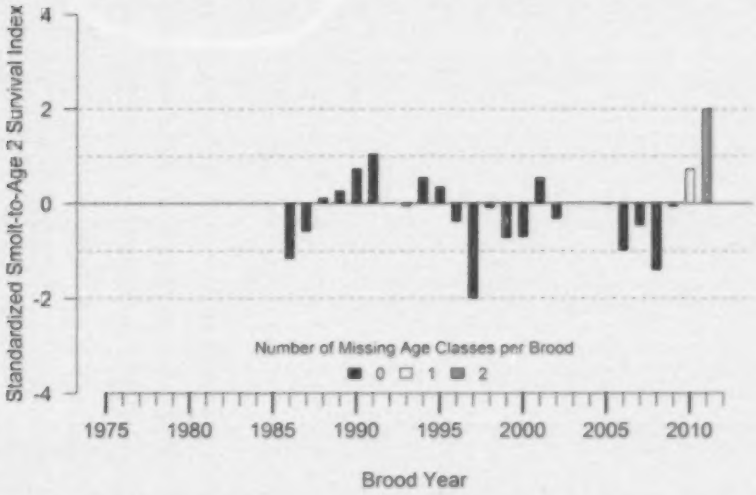


Figure 3.17.–Marine survival index (standardized to a mean of zero) for subyearling releases of the Atnarko River stock of Chinook salmon, 1986–2011 brood years. There were no CWT releases for brood years 2003 and 2004.

Escapement estimates of large adults (total wild and hatchery, excluding jacks) have exceeded S_{MSY} in all years except in 2012 when the escapement estimate was 4,622. The 2012 escapement of large adults was, however, greater than the 0.85 S_{MSY} lower threshold of 4,258, thus falling in the escapement buffer zone (Figure 3.18). Since mature-run equivalent exploitation rates have been below the threshold reference line in all years, this stock has been in the safe zone for all years except in 2012 (Figure 3.19). Wild large Atnarko Chinook have also exceeded S_{MSY} in all years except in 1997 and 2012, when the escapement estimates were below S_{MSY} at 4,013 and 2,542, respectively (Figure 3.18).

Figure 3.18.–Time series of Atnarko Chinook escapement integrating the calibrated values from best Generalized Linear Model and the best Maximum Likelihood estimates for years with mark–recapture studies (2001–2003 and 2009–2015).

Note: Time series are shown for total escapement including hatchery and wild females (F), males (M), and jacks (J), large adult escapement including hatchery and wild F and M, and large wild escapement including only wild F and M. The dashed line shows the habitat-based escapement goal.

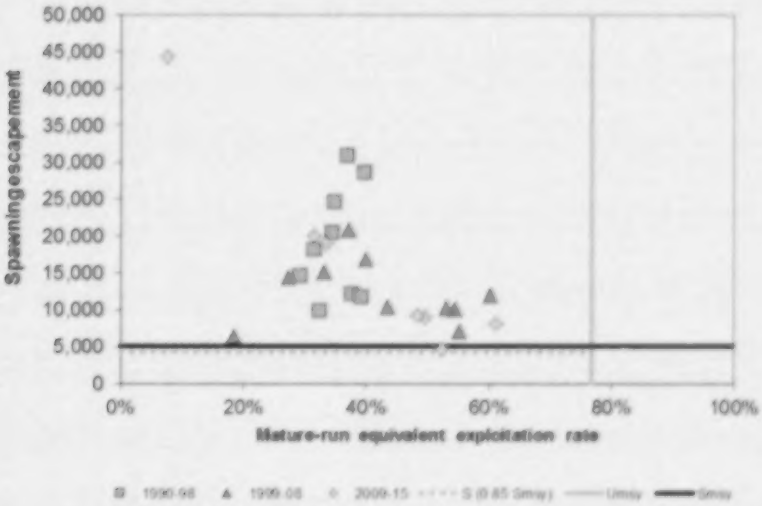


Figure 3.19.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Atnarko River stock of Chinook salmon, 1990–2015.

Note: Spawning escapement excludes jacks to be consistent with the units represented by the S_{MSY}-based escapement goal.

3.2.3.3 Lower Strait of Georgia: Cowichan River

The Lower Strait of Georgia natural stock group includes the Cowichan River and Nanaimo River escapement indicators. Currently, only the Cowichan has a CTC-accepted escapement goal. A habitat-based estimate of S_{MSY} is available for the Nanaimo River; however, the exploitation rate indicator program was discontinued after brood year 2004. The Cowichan River is an exploitation rate indicator stock that has escapement estimates produced by fence (weir) and MR methods. This stock has had a high level of enhancement (mean enhanced contribution = 24%) for run years 1982–2011 (Figure 3.20), which influences the representativeness of this stock for others in Lower Strait of Georgia. The largest contribution occurred in 2002 (59%). Tompkins et al. (2005) reviewed the Cowichan data and estimated the stock–recruit relationship. Marine survival was generally above average for brood years 1985 to 1992, below average from 1993 to 2009, and slightly above average in 2010 and about average in 2011 (Figure 3.21). The cumulative exploitation rates have been above the threshold reference line in about 80% of the years and escapements have been below S_{MSY} since 1997 (Figure 3.22). The stock has rarely been in the safe zone of the synoptic plot, only once during the last 26 years, with most of the recent years in the high risk zone. The stock experiences the highest exploitation of the stocks examined in Section 3.

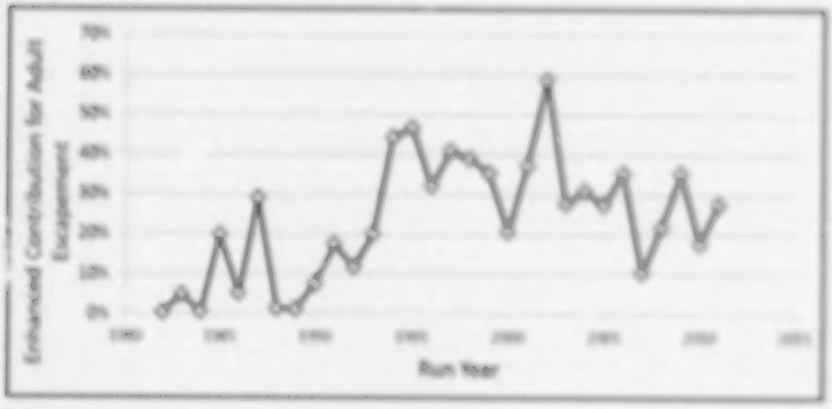


Figure 3.20.–The percentage of first generation hatchery-origin Chinook salmon in the Cowichan River adult escapement, 1982–2011.

Note: 2012 data are not yet available.

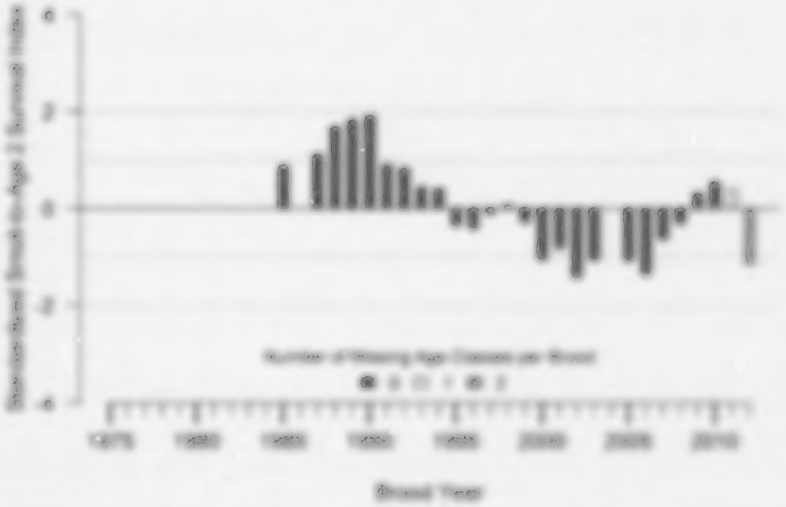


Figure 3.21.–Marine survival index (standardized to a mean of zero) for the Cowichan River stock of Chinook salmon, 1985–2012 brood years. Brood years 1986 and 2004 were not represented by CWTs, thus no data are available.

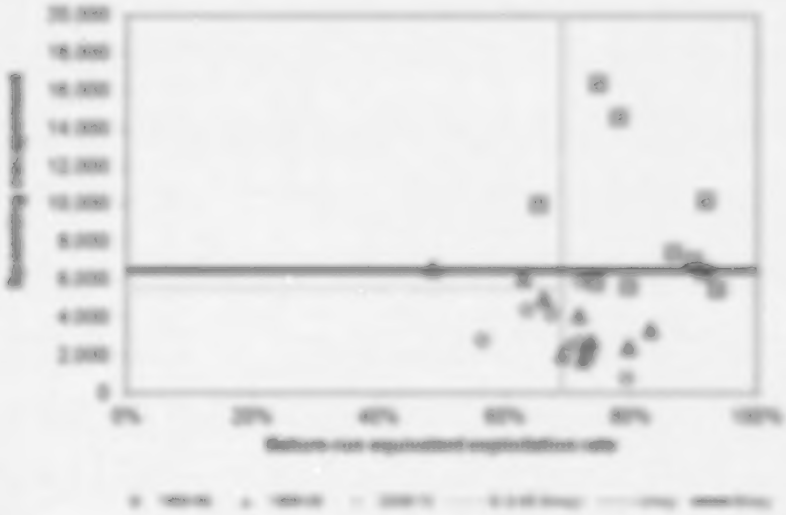


Figure 3.22.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Cowichan River stock of Chinook salmon, 1989–2015.

3.2.3.4 Fraser River Stocks

Within the Fraser River, three of five escapement indicator stocks are represented currently by exploitation rate indicator stocks. The Fraser River spring run age 1.2, Fraser River summer run age 0.3, and Fraser River late run are represented by the exploitation rate indicator stocks at the Nicola, Lower Shuswap, and Harrison rivers, respectively. Fraser River spring run age 1.3 and Fraser River summer run age 1.3 are not currently represented by CWT-based indicator stocks.

3.2.3.4.1 Fraser River Spring Run Age 1.2: Nicola River

The Fraser River spring run age 1.2 stocks are small-bodied, early-maturing stocks that spawn in tributaries to the Lower Thompson River, Louis Creek in the North Thompson River, and Bonaparte Creek in the South Thompson River. The Nicola River is an exploitation rate indicator stock that has escapement estimates produced by MR methods. Currently, there are no (TS)-agreed escapement goals for this group. Harvest occurs almost exclusively during the return migration, while passing through approach fisheries and within the gauntlet of Fraser River fisheries. Escapement estimates declined steeply between 2003 and 2009, and currently this is a stock group of concern for Canadian fishery planning. This stock has had a high level of enhancement (mean enhanced contribution = 28%, run years 1987–2010), which influences its representativeness for unenhanced stocks in the stock group (Figure 3.23). Hatchery contribution averaged 19% over the last 12 years.

The reference lines in Figure 3.24 were estimated from habitat-based methods (Parken et al. 2006). The Nicola River stock has been in either the low escapement and low exploitation or safe zone of the synoptic plot in all years. Since 2009, the stock has been in the low escapement and low exploitation zone, which indicates that smolt survival, freshwater survival, or their interaction have contributed to low production.

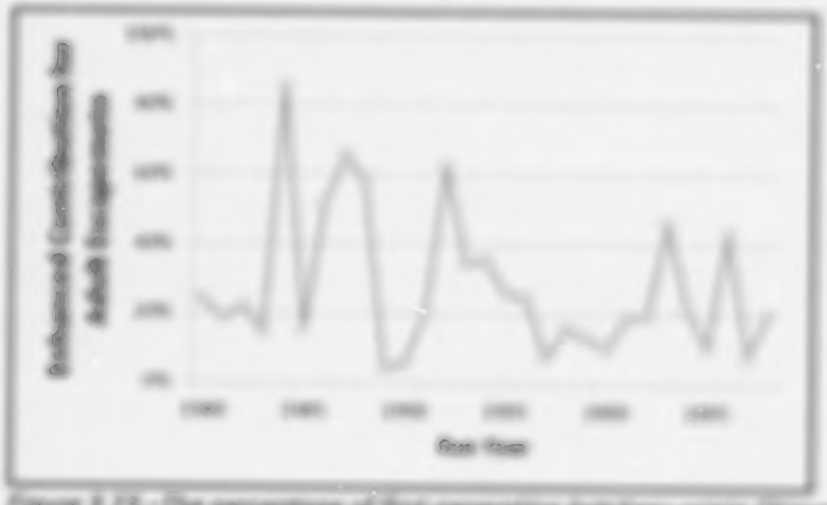


Figure 3.23 – The percentage of first generation hatchery-origin Chinook salmon in the Nicola River escapement, 1987–2010.

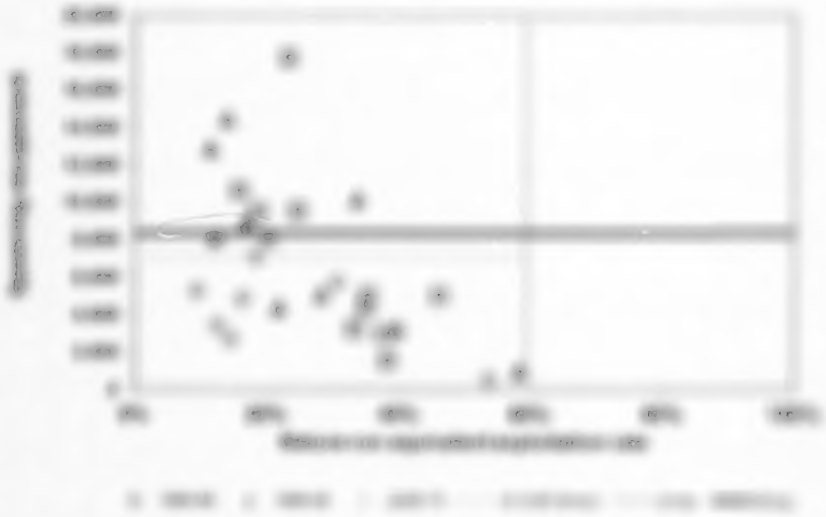


Figure 5.26: Mixture non-equivalent exploitation rate, spawning escapements and threshold reference lines for exploitation rate and spawning escapement by (7) for the Kuskokwim stock of Chinook salmon, 1985–2015.

There was a shift to a below average marine survival regime beginning in brood year 2005, which appears similar to the pattern described previously for the suitable spring stocks in Alaska (Figure 5.25). Cohorts that entered the ocean in 2005, 2007 and 2012 (return years 2007, 2009, and 2014) survived particularly poorly, however, 2010 returns were much more abundant, suggesting that cohort had high freshwater production. A pattern of alternating years of very poor escapements has persisted due to the weak returns from those smolts despite increased conservation measures. Survivals decreased sharply with the 2008 brood (2002 ocean entry) and subsequently remained below average, with the modest exception of the 2008 brood (2009 ocean entry, Figure 5.25). The very low survival for the 2005 brood year was caused by a Myxobacteria infection at Spius hatchery, and the survival for the 2008 brood year was affected by high prespawn mortality in 2009 (not measured). Rebuilding will require a sustained return to more favorable survival conditions.

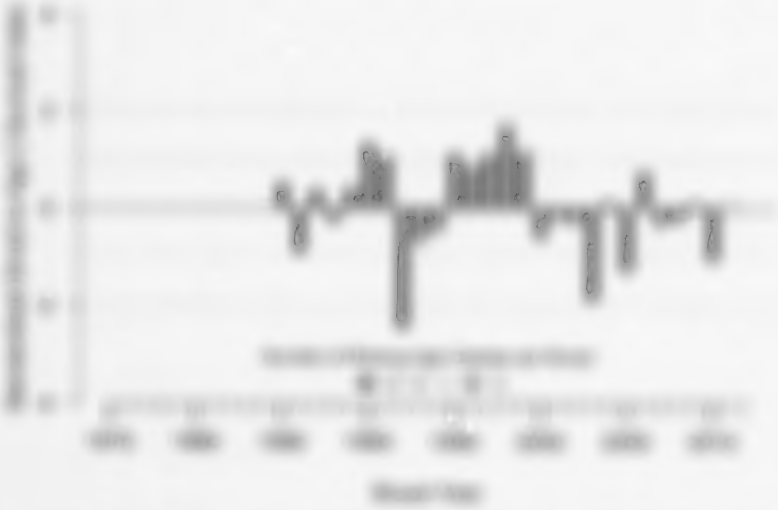


Figure 5.25. Alberta survival index (standardized z-score mean of every 5th Atlantic River count of Chinook salmon), 1985–2012 (brood year).

5.5.3.5.2 Fraser River Summer Run Age 0.3 Lower Shuswap

The Fraser River summer run age 0.3 stocks are the north migrating, ocean type stocks that return to Alberta Bluff (lower Fraser River), the lower Thompson River, and South Thompson River and Shuswap. These fish remain in the commercial troll for their entire marine residence and are catchable in Canada throughout their spawn and terminal return migration, in both marine and Fraser River fisheries. Escapements to this stock group increased from about 20,000 through the 1980s to more than 100,000 between 1998 and 2012, peaking in 2010 at an estimated 140,000 fish, and declining steeply in 2012 to above 40,000 fish. The lower Shuswap River is an exploitation rate indicator stock that has escapement estimates produced by mark-recapture since 1998. Currently, there are no CTC agreed escapement goals for this stock and the difference has been estimated from relative hatchery contribution (Porter et al. 2006). The stock has had a low to moderate level of enhancement (mean enhanced contribution = 7%, run years 1987–2012), which influences its representativeness for unenhanced stocks in this stock group (Figure 5.26). Hatchery contribution averaged 10% over the last 5 years.

Marine survival has been fluctuating since 1985; however, all brood years since 2000 (except for 2006 and 2010) have been below average (Figure 5.26). Survival increased considerably for the 2010 brood year, leading to a high abundance of age 0.3 fish in the 2013 run (age 0.3 fish in 2014 escapements). Survival decreased considerably in 2012 (incomplete brood). The cumulative exploitation rates have been below the threshold reference (low) in all four run years and escapements have exceeded S_{MSY} in all four run years (1998 and 2012). Figure 5.27. The lower Shuswap CWT stock has been in the 95th percentile in all four run years since implementation of the 2008 Agreement, six years prior to the 95th percentile, 10 of 10 and 2012 was in the low escapement and low exploitation zone.

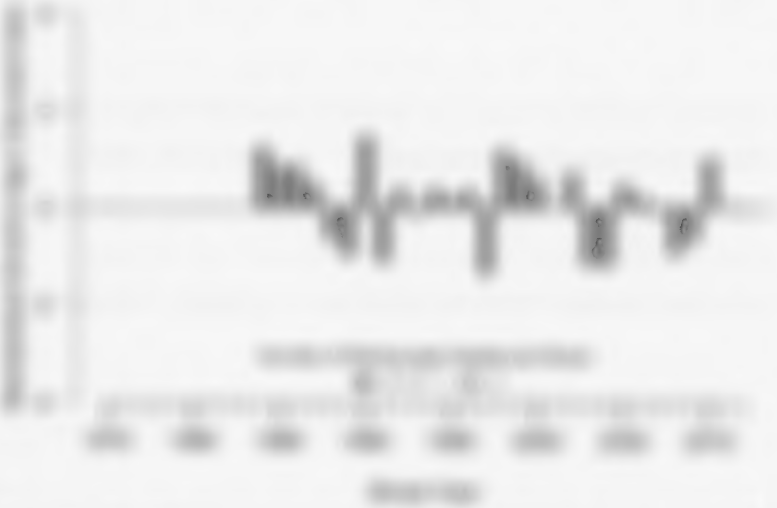


Figure 4.2.30 – Effective personal income tax revenue deficit (%) as a share of GDP, Nile Lower Chiromaja River valley of Kirkwala province, 2000–2019 (Kirkwala pass)

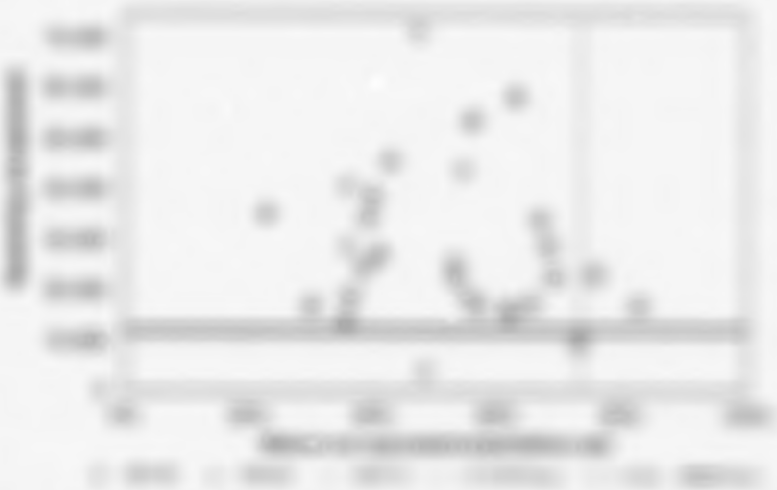


Figure 4.2.31 – Effective tax expenditure capitalization index, personal income tax, and Kirkwala fiscal deficit as share of GDP, Nile Lower Chiromaja River valley of Kirkwala province, 2000–2019

5.2.3.3.1 Fraser Lake – Harrison River

The Fraser lake basin was along Nicola Valley in Kirkwala province, originating from the Harrison River. Hydrologists of Harrison Lake in the Lower Fraser River, connecting Hagaleh to the Fraser delivery concessions, after consequence and tension in the service area the 1 in 10 to apply notice in meanings into the Strait of Georgia. Fraser water distribution is particularly in the dated Nay, 2019.

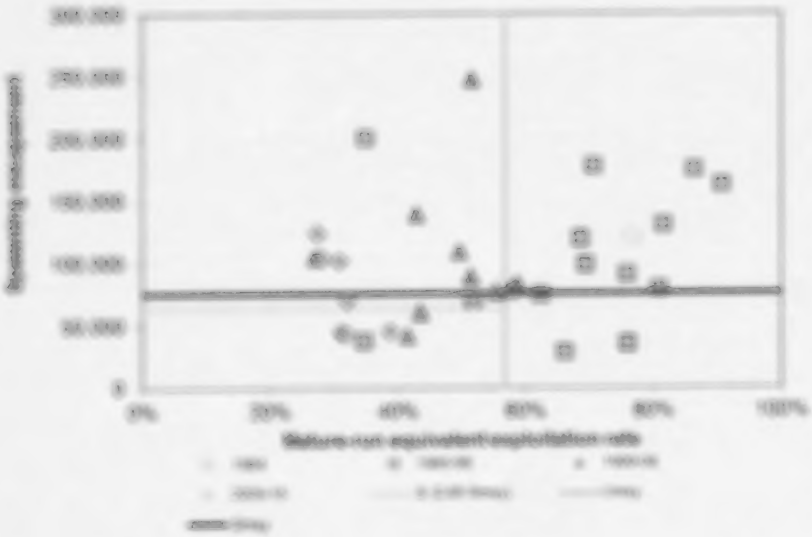


Figure 3.29.—Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Harrison River stock of Chinook salmon, 1998–2015.

3.2.4 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

3.2.4.1 Puget Sound

Puget Sound stocks are a mixture of natural- and hatchery-origin production of spring run and summer/fall run fish. This mix of hatchery- and natural-origin production influences both the fisheries within Puget Sound, where terminal fisheries target abundant hatchery stocks, as well as the escapement to the spawning grounds, which contains many hatchery strays in some cases. Consequently, historic patterns of wild Puget Sound Chinook salmon abundance may be obscured because of the interaction of hatchery- and natural-origin production in the fishery and escapement accounting. Hatchery programs in Puget Sound have annually released between about 23 million (1976) to over 56 million (1989) Chinook salmon (Figure 3.30). Since Puget Sound Chinook salmon were listed as threatened under the ESA in 1999, hatchery production has averaged about 33 million releases annually. Although Puget Sound hatchery programs historically emphasized production for fisheries alone, many of today's programs are also associated with endangered species recovery or wild broodstock CWT indicator programs.

Spring run stocks in Puget Sound exhibit both ocean-type (age-0 fingerling outmigrants) and stream-type (age-1 yearling outmigrants) life histories. Key spring stocks are the PSC escapement indicators in the Nooksack and Skagit rivers, as well as the White River (PSC CWT indicator), with associated hatchery programs in each. Escapement in the Nooksack River is predominately hatchery-origin fish, whereas on the Skagit River, hatchery-origin fish are rarely

seen in the spawning areas. Summer/fall run stocks are predominately ocean-type fish and this run timing group comprises the majority of Chinook salmon production from Puget Sound. Skagit River summer/fall Chinook salmon is the largest stock in Puget Sound, and consists almost exclusively of natural-origin fish. The Skagit and Stillaguamish rivers have PSC CWT exploitation rate indicator stocks and supplementation programs (Stillaguamish only) that use broodstock collected from the spawning grounds. Basins with large hatchery programs include the Snohomish and Green PSC escapement indicators as well as the Samish, Puyallup, Nisqually and Skokomish rivers. In addition, net-pen programs in Bellingham and Tulalip bays release large number of juvenile Chinook salmon.

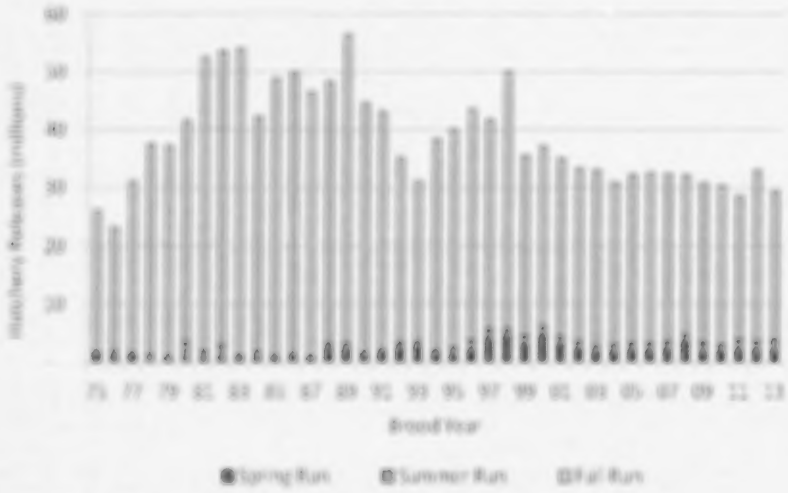


Figure 3.30.–Chinook salmon released from Puget Sound hatcheries, 1975–2013 brood years.

Estimates of total production for the Puget Sound PSC escapement indicator stocks have not been made in part because of the lack of long-term representative tag groups for the natural stocks (except Green River). The trend in the escapement of Puget Sound summer/fall PSC escapement indicator stocks is driven primarily by the status of Skagit River summer/fall Chinook salmon. Consequently, the status and trend of Puget Sound summer/fall Chinook salmon will track with the abundance of Skagit River fish, because in most years the abundance of Skagit River fish is higher than the sum of the escapement of the other PSC indicator stocks. This is especially true when the escapement of Skagit River summer/fall Chinook salmon averaged 17,900 from 2000 to 2006, and exceeded 20,000 from 2004 to 2006. For the period of 1975 to 2014, the aggregate escapement of Puget Sound summer/fall indicator stocks has ranged from a low of about 12,000 in 2009 and 2011, to a high of 45,000 in 2004 (Figure 3.31). The aggregate escapement was 23,739 in 2015, which is higher than the escapements in 2013 and 2014. Terminal harvest data for 2015 have not been reviewed by co-managers, although indications are that catches were low, similar to 2014. None of the Puget Sound Chinook salmon stocks have CTC-accepted escapement goals.

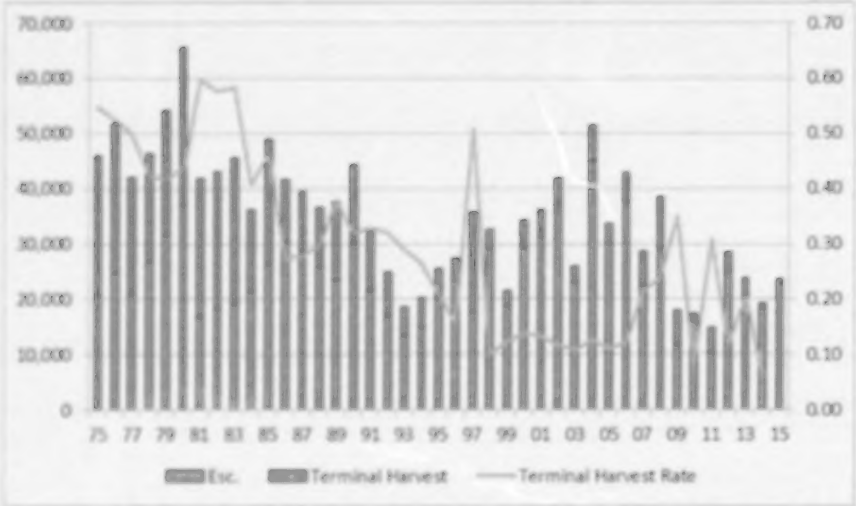


Figure 3.31.–Escapement and terminal fishery harvest for the aggregate of Puget Sound summer/fall Chinook salmon PSC escapement indicator stocks.

The harvest rate in terminal fisheries for these stocks has generally declined from between 40% and 50% in the early 1980s to about 10% at the time of listing under the ESA in 1999. In most years, the majority of the terminal fishery harvest has depended on the status of Green River Chinook salmon and to a lesser extent on Skagit River fish. Directed terminal fisheries do not occur on Snohomish River, Stillaguamish River, and Lake Washington Chinook salmon.

The long-term escapement trends for Puget Sound Chinook salmon stocks cannot be identified with certainty because of the inability to assess total production of natural stocks in Puget Sound, coupled with the changes in fishery patterns and hatchery production over the 1975 to 2015 time period. Data limitations notwithstanding, it is still possible to make some generalizations about the current status of Puget Sound escapement indicators based on the recent past at both the aggregate and individual population levels. Spring Chinook salmon in the Nooksack and Skagit rivers, for example, exhibit annual variability with no apparent escapement trend. Overall, summer/fall escapements have declined notably from near-peak levels in the recent decade and in a manner commensurate with the declines of the 1990s that led to ESA listing. Examined at the individual stock level, however, some variation on this general theme emerges (Section 2.3.4). With the exception of Lake Washington, the average summer/fall escapements in 2009–2015 were lower than the long-term average during 1999–2015. Although it is important to acknowledge the influence of the time period choice on conclusions about recent abundance trends (i.e., near-record escapements were seen for many Puget Sound populations in the early 2000s), the observation of low escapements in recent years for multiple populations suggests this group of stocks remains depressed overall. Future assessments of escapement trends should attempt to separate hatchery strays from natural-origin spawners, where data permit.

3.2.4.2 Coastal Washington

Coastal Washington is the only region in the state accessible to anadromous salmonids where Chinook salmon are not listed under the US ESA. Consequently, salmon fishery management of the coastal Chinook salmon stocks in this region has one less regulatory framework to consider each year, but still has to balance conservation needs with state and tribal comanagement, federal fishery management plans, and international agreement under the PST. Additionally, compared to Puget Sound, the confounding influence of hatchery production on trend assessments is considerably less.

The aggregate escapement of spring and summer Chinook salmon PSC escapement indicator stocks in the Queets, Quillayute, and Hoh rivers and Grays Harbor ranged from a high of 11,740 in 1989 to a low of 2,316 in 2007 (Figure 3.32). Queets River spring/summer and Quillayute River summer Chinook salmon populations have not met escapement goals in the majority of years since 1999, and both the Hoh and Quillayute stocks exhibit escapement trends indicating considerable decline since the late 1980s but consistency since the 1999 PST went into effect (Section 2.3.4). Terminal harvest rates on these stocks have averaged less than 15% since the mid-1990s, and were 7% in 2013—the last year available. There are no representative PSC indicator tag groups for these stocks. However, CWT groups were released from Sol Duc Salmon Hatchery in the Quillayute Basin in the early 1990s and were discontinued for about 10 years before starting new tagging programs with the 2004 brood. Based on limited information from these tag groups that generally showed poor survival, the Quillayute stock has a northerly ocean catch distribution. Exploitation rates cannot be determined because recoveries are low and escapement area sampling appears inadequate in some years.

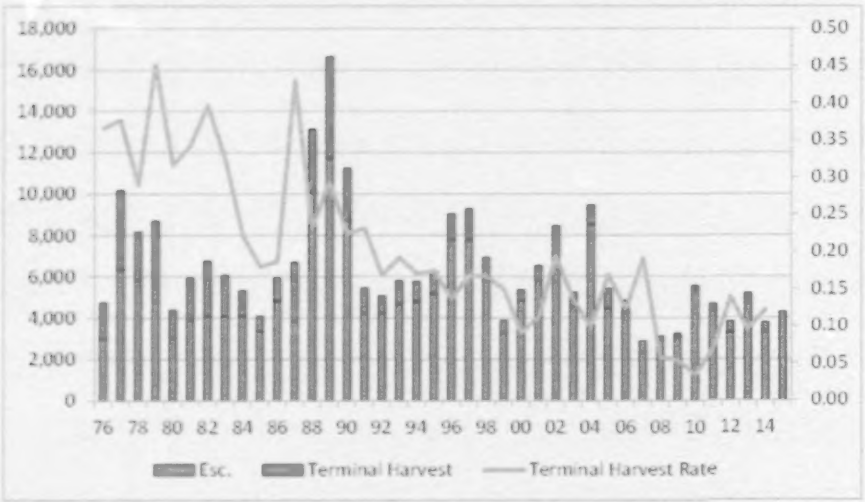


Figure 3.32.–Escapement and terminal fishery harvest for the aggregate of Washington coastal spring/summer Chinook salmon PSC escapement indicator stocks.

Note: Terminal harvest not available for last year.

Coastal Washington fall Chinook salmon escapement indicators include Queets, Quillayute, Grays Harbor (accepted in 2014), and Hoh stocks that have CTC-approved escapement goals, along with the Hoko stock that only has an agency management goal. Aggregate coastal fall Chinook salmon escapement has ranged from a low of 13,801 in 1983 to a high of 57,634 in 1988 (Figure 3.33). Similar to spring/summer stocks, coastal fall stocks are characterized by escapement declines since the highs of the late 1980s, and generally stable escapements in the more recent past (Section 2.2.4). Over the entire 1975 to 2013 time period (2014 and 2015 not available at this time), terminal harvest rates have varied substantially without a definitive trend, and have averaged about 32% since 1999. With the exception of the Hoko where there are no terminal fisheries, harvest in terminal fisheries is a mixture of directed catch on Chinook salmon and incidental catch while targeting other species (Figure 3.33).

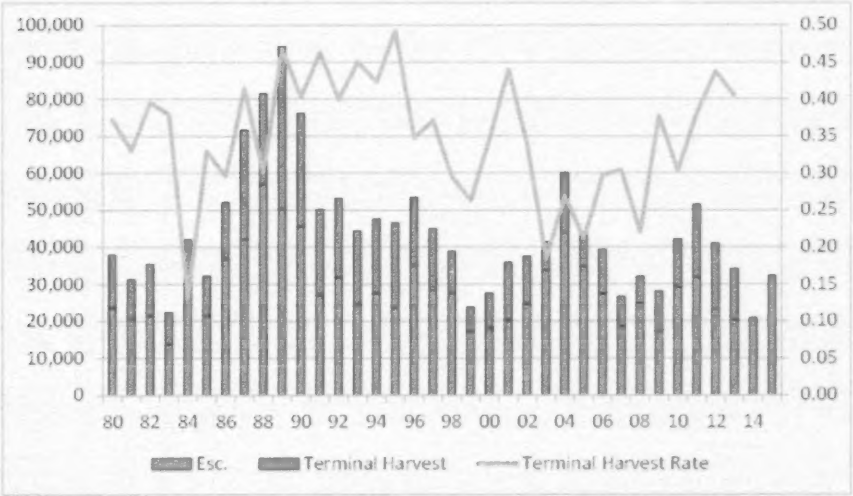


Figure 3.33.–Escapement, aggregate escapement goal and terminal fishery harvest for the aggregate of Washington coastal fall Chinook salmon PSC escapement indicator stocks.

Note: Terminal harvest not available the last two years.

Unlike in Puget Sound where hatchery production is significant and widespread and can complicate natural stock accounting, fall Chinook salmon hatchery production is more limited on the Washington Coast and not extensive in the PSC indicator stock basins. Hatchery programs that currently release fall Chinook salmon in the PSC indicator stock basins include the Hoko Falls Hatchery that releases smolts for natural stock supplementation/CWT indicator stock purposes, Salmon River Fish Culture Hatchery in the Queets Basin, and Humptulips Salmon Hatchery in the Grays Harbor watershed. Other significant programs outside of the PSC escapement indicator stock programs include releases from Makah National Fish Hatchery on Tsoo-Yess River (formerly Sooes River), Quinault National Fish Hatchery on Cook Creek in the Quinault Basin, and Forks Creek Hatchery in Willapa Bay. All of these hatchery programs influence the management of terminal fisheries and the extent of directed harvest on fall run Chinook salmon.

Despite the lack of clear trends in escapement for coastal Chinook salmon stocks (Section 2.2.4), conclusions on stock status and population trend are speculative without a full run reconstruction (CWT-based) that can account for total production. Ocean fishery impacts for these stocks can, however, be estimated using the Queets CWT indicator tag group. From a simple fishery distribution basis, the portion of the Queets stock impacted in ocean fisheries shows no apparent trend and has averaged about 44% of the total accounting in all fisheries and escapement since 1985 (CTC 2014). Since ocean fishery impacts show no trend and terminal returns have declined since the late 1980s, it appears that total adult production has also declined. Further investigation and analysis is needed to confirm this generalization.

Queets CWT indicator tag groups were used to produce plots for a synoptic evaluation of the three coastal Washington fall Chinook salmon stocks with CTC-approved escapement goals in 2013—Queets, Quillayute, and Hoh rivers. Queets CWT groups were assumed to be representative of the exploitation and ocean distribution of Quillayute and Hoh stocks. All three stocks have active terminal fisheries with similar terminal fishery harvest rates; therefore, Queets CWTs are considered a suitable surrogate to estimate exploitation in the Quillayute and Hoh rivers.

A simultaneous evaluation of spawning escapement and cumulative MRE exploitation rates shows management of Queets River fall Chinook salmon (Figure 3.34) in the safe zone with spawning escapement exceeding the goal and exploitation rates below S_{MSY} in all years except 1999 and 2007. Management for escapement and mature-run exploitation rate was in the safe zone in all years for Quillayute (Figure 3.35) and Hoh (Figure 3.36) rivers. Productivity of these stocks is high, evidenced by their high U_{MSY} (0.87 for Queets and Quillayute; 0.90 for Hoh), which provides for less stringent management than some stocks with lower U_{MSY}. From this synoptic evaluation perspective, these coastal Washington stocks exhibit a track record of sustainable management. Further, this view of the fishery impact and escapement data suggests that much of the variation in escapements for these stocks has been driven by nonfishing factors (e.g., anomalously high or low marine survival).

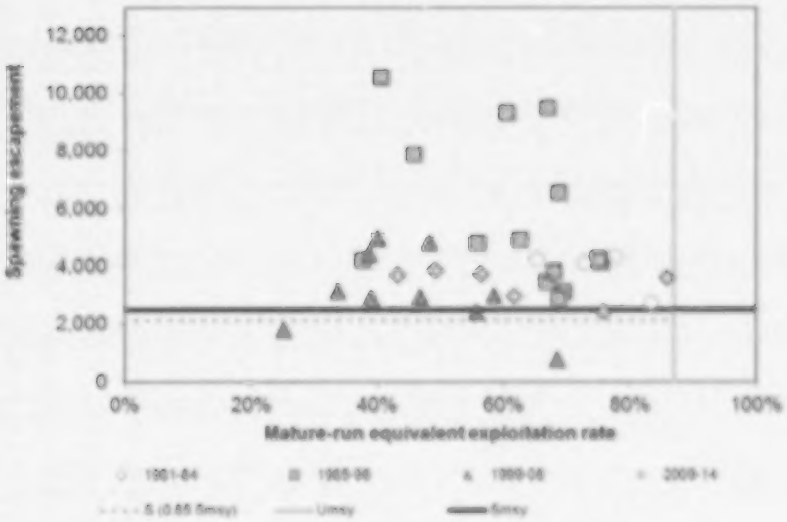


Figure 3.34.–Queets River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River PSC indicator CWTs.

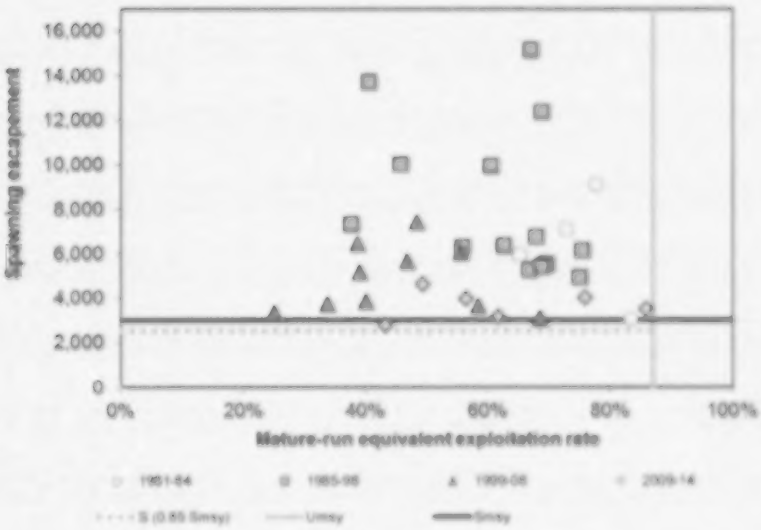


Figure 3.35.–Quillayute River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River PSC indicator CWTs.

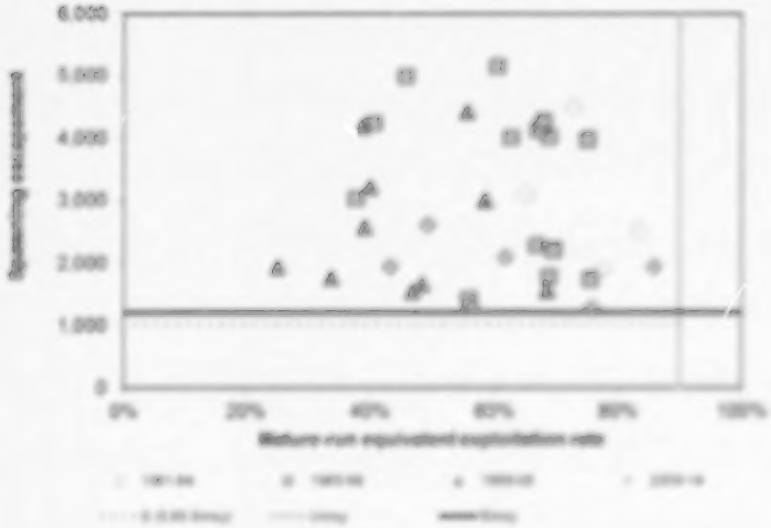


Figure 3.36.–Hoh River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River PSC indicator CWTs.

3.2.4.3 Columbia River

3.2.4.3.1 Columbia River Summers

Columbia Upriver Summer Chinook is the only escapement indicator stock in this stock group. Since 2008, Columbia Upriver Summer Chinook have been managed inriver by comanagers for a spawning escapement of 17,000, including 13,500 Wenatchee/Entiat/Chelan tributary spawners, 3,500 Methow/Okanagan tributary spawners, and an additional 3,000 fish for hatchery brood stock. Inriver fisheries are managed using a sliding scale of harvest rates based on the expected terminal run size.

For consistency with the CTC escapement goal, the synoptic evaluation shows combined hatchery and wild fish past Rock Island Dam (Figure 3.37). Although survival rates have been slightly below average, the counts of Chinook salmon past Rock Island Dam have exceeded 40,000 since 2009 while the stock experienced MRE exploitation rates of 51% to 71%. The CTC goal of 12,143 summer Chinook salmon past Rock Island Dam was developed prior to sport and nontreaty tribal fisheries that now take place above Rock Island Dam, so the recent dam counts overestimate escapement. The simultaneous evaluation of spawning escapement and cumulative MRE exploitation rates shows management of Columbia River Upriver Summers (Figure 3.37) in the safe zone of spawning escapement—exceeding the goal and exploitation rates below U_{MSY} from 2009 to 2013. In 2014 and 2015, the stock was in the high escapement–high exploitation rate zone. Columbia Upriver Summers have demonstrated normal variation in survivals (within about 2 standard deviations). Although survivals have been predominantly positive since 1998, the age-2 survival index for brood year 2010 fails to show the large positive deviation demonstrated by Columbia River fall stocks (Figure 3.38).

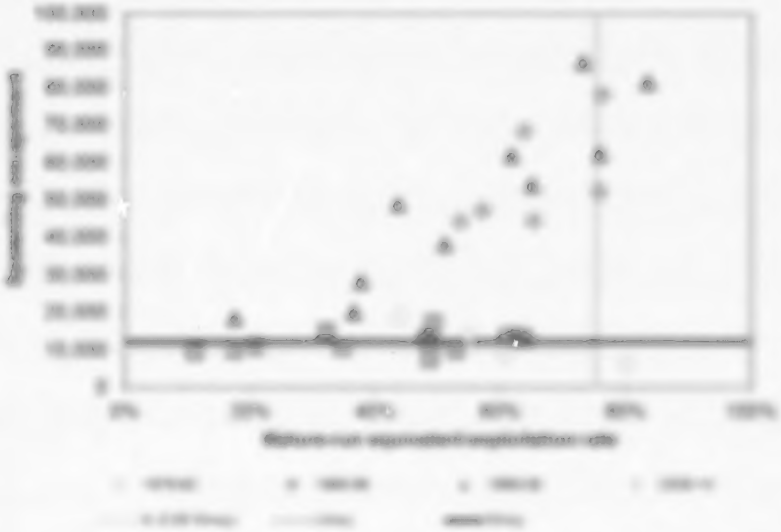


Figure 3.37 – Columbia Upriver Summer Chinook salmon spawning escapement past Rock Island Dam and cumulative mature-run equivalent exploitation rate calculated from Wells Hatchery PSC indicator CWTs.

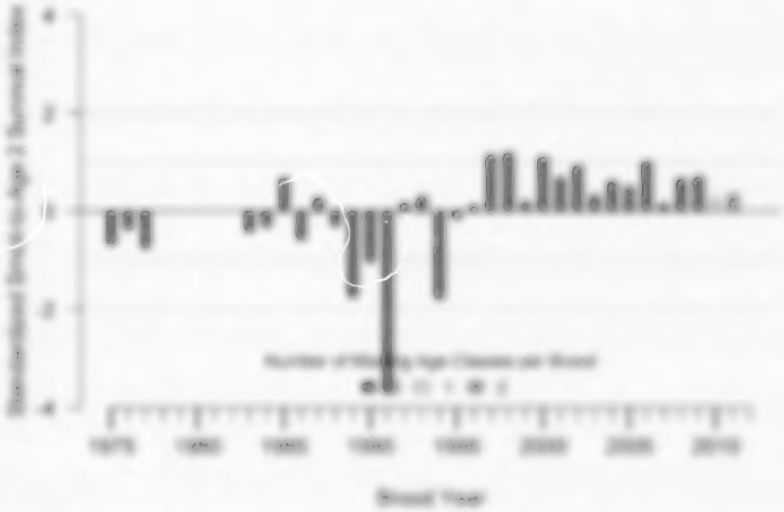


Figure 3.38 –Marine survival index (standardized to a mean of zero) for Columbia Upriver Summer Chinook salmon.

3.2.4.3.2 Columbia River Fall

The Columbia River Falls stock group in the Attachments to Chapter 3 has three escapement indicator stocks: Upriver Brights, Deschutes, and Lewis. The Upriver Bright management unit is

comprised of all bright fall Chinook salmon returning to areas above Bonneville Dam, including Deschutes, upper Columbia and Snake river populations. The CTC agreed escapement goal for the Upriver Bright Chinook of 90,000 adult spawners past McNary Dam has been met since 1993, and the CTC goal of 4,532 Deschutes River fall Chinook salmon has been met since 1993. NRE exploitation rates have varied widely between 44% and 76% (Figure 5.39, Figure 5.40). The simultaneous evaluation of spawning escapement and cumulative NRE exploitation rates shows management of Upriver Brights and Deschutes River fall Chinook (Figure 5.39, Figure 5.40) in the safe zone or the high escapement/high exploitation zone in all years since 1998.

The CTC escapement goal of 5,700 Lewis River fall Chinook salmon has been met since 2003, except for 2007 to 2009, when tributary returns were insufficient to meet escapement needs, even in the absence of tributary fishing. Exploitation rates since 1993 have never exceeded the estimated U_{MSY} (Figure 5.41).

Standardized survival indices for Columbia River fall fish have been positive based on wild Hanford Reach CWT data, and Priest Rapids Hatchery CWT data (Figure 5.42 and Figure 5.43) for the 2008 through 2011 broods. However, the single age class data available for the 2011 brood of Lewis River wild fall fish showed a drop from near average for the 2009 and 2010 broods to more than a standard deviation negative (Figure 5.44).

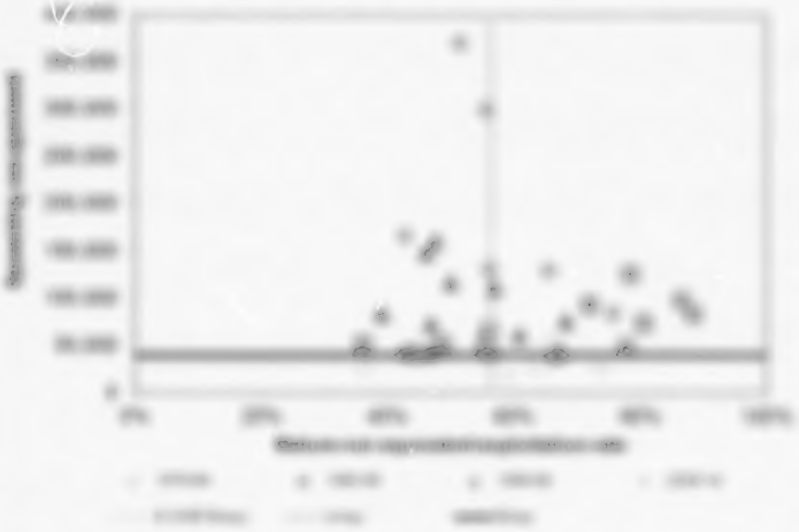


Figure 5.39 – Upriver Bright fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Priest Rapids Hatchery PSE indicator CWTs.

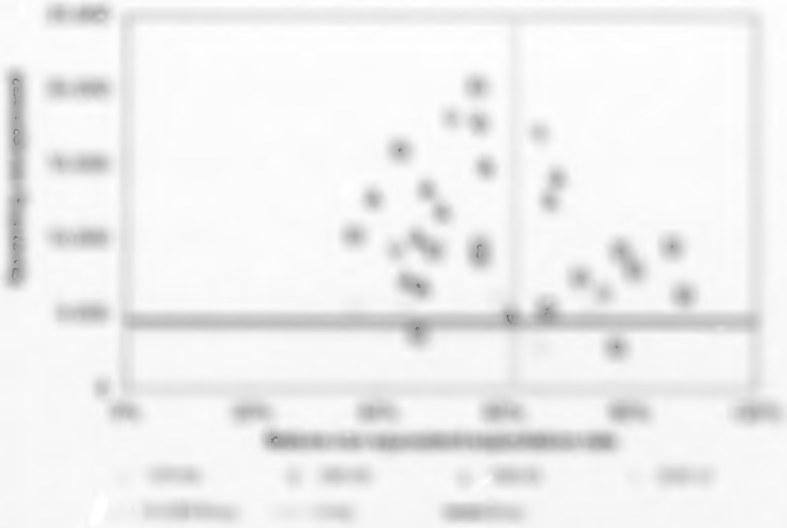


Figure 5.42: Beechwater River (left Chinook) without spawning escapement and cumulative mature not equivalent exploitation rate calculated from Fraser Rapids Interface, PSC indicator (197%).

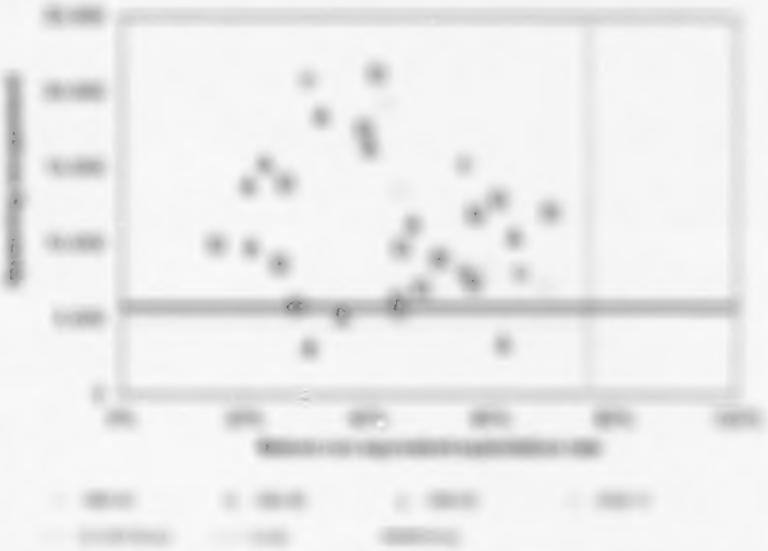
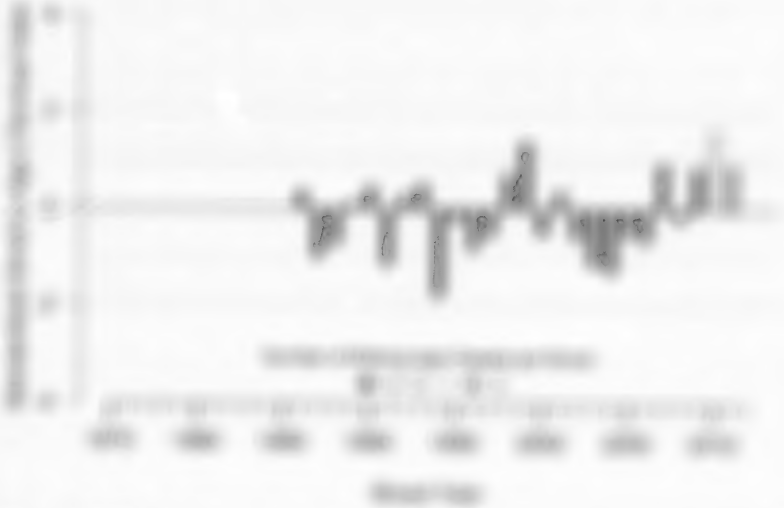
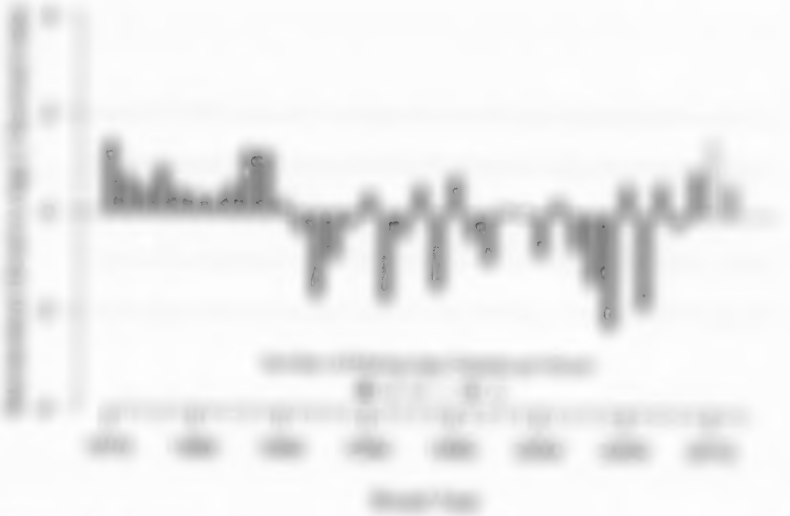


Figure 5.43: Lewis River WRB (left Chinook) without spawning escapement and cumulative mature not equivalent exploitation rate calculated from Lewis River WRB PSC indicator (197%).





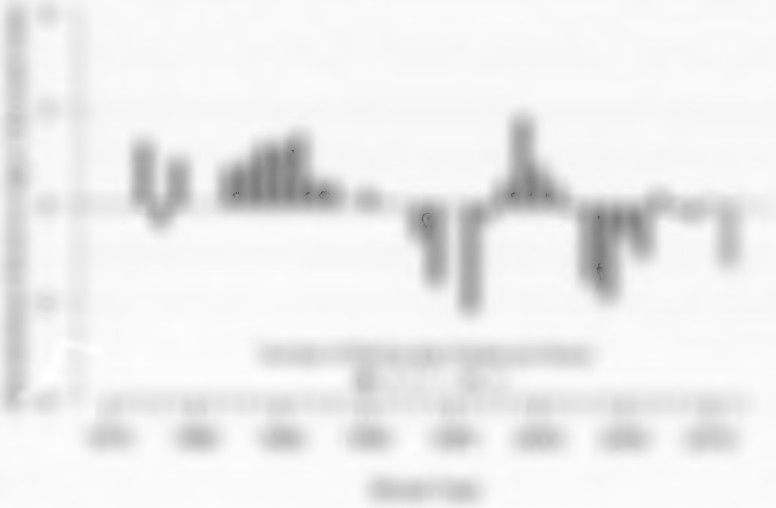


Figure 4.3.8b: Alternative summary bubble chart (standardized to a common y-axis) for the Mean Value dimension of selected systems.

4.3.3 Grid Footprint Divergence

Scope 2 Gross Footprint Divergence

Grid intensities vary by orders of magnitude across the 100 GPAI aggregate cloud. Two cloud regions operated by the same provider can differ by a factor of ten or more. This variation means that the choice of deployment region is one of the most consequential decisions a cloud customer can make. The distribution of cloud capacity across regions with very different grid intensities is a structural feature of the global cloud market, not a temporary anomaly.

When this heterogeneity is fed into GPAI-T2, GPAI-T3, and GPAI-T4 using aggregate grid intensities, the resulting Scope 2 footprints differ by a factor of three or more between the most and least favourable regions. This divergence is not a flaw in the methodology. It is the methodology working as intended. Footprints calculated from aggregate averages are not comparable across regions because they embed a structural difference in grid composition that has nothing to do with the efficiency of the underlying compute. The divergence is visible in Figure 4.3.9. The chart shows the distribution of Scope 2 footprints across the 100 GPAI aggregate cloud, with the three regions that dominate cloud capacity in the EU, US East, and Asia-Pacific highlighted. The spread between the lowest and highest footprints is wide enough that a customer choosing between two regions could halve their reported footprint by changes that have no effect on the actual work being done.

This divergence matters for commercial decisions, carbon-aware scheduling, and regulatory reporting. A customer that optimises its workloads for carbon intensity will shift capacity toward the lower-intensity regions. The methodology must be able to track that shift and report it as a reduction in footprint. If the methodology cannot distinguish between a genuine efficiency improvement and a change in grid composition, it will reward the wrong behaviour.

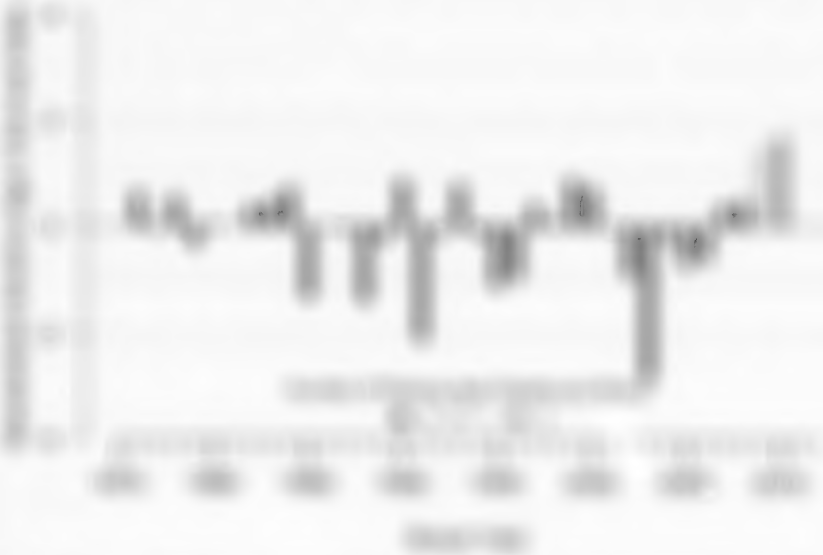


Figure 4.1 Mean Cumulative Abnormal Returns (MCAR) for Sample Firms

Figure 4.2 Mean Cumulative Abnormal Returns (MCAR) for Sample Firms with Positive Abnormal Accruals and Negative Abnormal Accruals

Table 4 Descriptive Statistics of Sample Firms

Variable	Mean	Median	Minimum	Maximum	Standard Deviation	Skewness	Kurtosis
Total Accruals (TA)	0.0	0.0	-0.0	0.0	0.0	0.0	0.0
Abnormal Accruals (AA)	0.0	0.0	-0.0	0.0	0.0	0.0	0.0
Cumulative Abnormal Returns (CAR)	0.0	0.0	-0.0	0.0	0.0	0.0	0.0
Mean Cumulative Abnormal Returns (MCAR)	0.0	0.0	-0.0	0.0	0.0	0.0	0.0

Table 5 Correlation Matrix

Variable	TA	AA	CAR	MCAR
Total Accruals (TA)	1.000	0.000	0.000	0.000
Abnormal Accruals (AA)	0.000	1.000	0.000	0.000
Cumulative Abnormal Returns (CAR)	0.000	0.000	1.000	0.000
Mean Cumulative Abnormal Returns (MCAR)	0.000	0.000	0.000	1.000

Table 6 Regression Results

Variable	Coefficient	Standard Error	t-statistic	Probability
Constant	0.000	0.000	0.000	0.000
Total Accruals (TA)	0.000	0.000	0.000	0.000
Abnormal Accruals (AA)	0.000	0.000	0.000	0.000
Cumulative Abnormal Returns (CAR)	0.000	0.000	0.000	0.000
Mean Cumulative Abnormal Returns (MCAR)	0.000	0.000	0.000	0.000

Table 7 Regression Results

Variable	Coefficient	Standard Error	t-statistic	Probability
Constant	0.000	0.000	0.000	0.000
Total Accruals (TA)	0.000	0.000	0.000	0.000
Abnormal Accruals (AA)	0.000	0.000	0.000	0.000
Cumulative Abnormal Returns (CAR)	0.000	0.000	0.000	0.000
Mean Cumulative Abnormal Returns (MCAR)	0.000	0.000	0.000	0.000

is needed to account for different terminal exploitation experienced between this stock and its model stock counterpart, the Salmon River Hatchery stock.

The Siletz River stock of Chinook salmon exhibit high productivity as demonstrated by one of the higher U_{MSY}s presented in this chapter. Most of the observed points of escapement and exploitation are within the safe zone, in spite of the likelihood that the exploitation rates may overestimate impacts on this stock. Recent year's escapements (2010–2014) have increased over lower escapements observed in return years 2007 to 2009.

The Siuslaw stock of Chinook salmon, similar to the Nehalem stock, has experienced a wide array of both escapement and exploitation since 1979 (Figure 3.40). Most of the observations of escapement below S_{MSY} occurred during the pre-Treaty period of 1979 to 1984. Since 2009, this stock has met or exceeded its escapement goal despite exceeding the U_{MSY} threshold in 3 years.

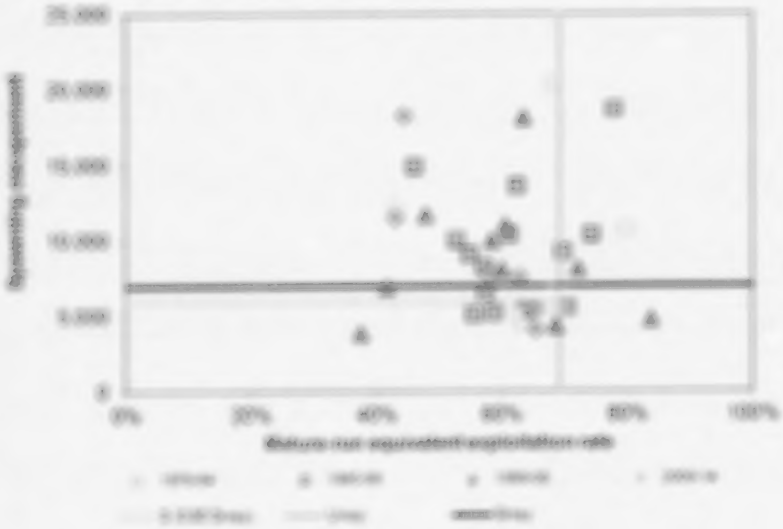


Figure 3.40.–Mature run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Nehalem River stock of Chinook salmon, 1979–2014.

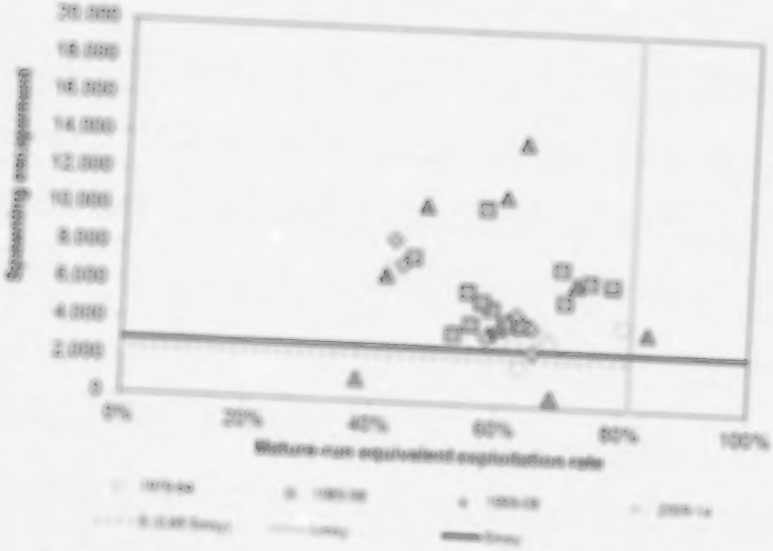


Figure 3.47.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Siletz River stock of Chinook salmon, 1979–2014.

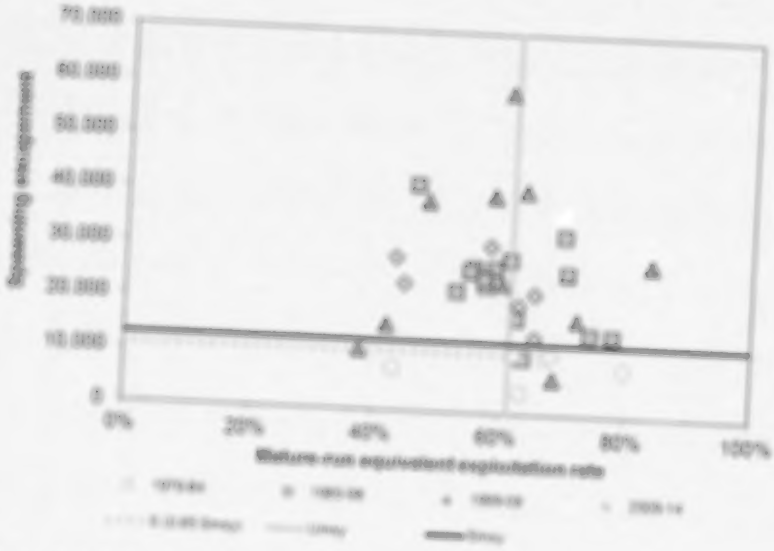


Figure 3.48.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Siuslaw River stock of Chinook salmon, 1979–2014.

3.2.4.4.2 Mid-Oregon Coast

After a period of declines in escapement from 2005 to 2008, the MOC stock aggregate rebounded to historical averages during the 2010–2015 return years. Total aggregated estimated escapement for the MOC has ranged from a low of 6,981 in 1976 to a high of 56,021 in 2010. The 10-year average (2006–2015) escapement for the MOC is about 29,000. Estimated escapement for the MOC stock group in 2015 was 53,794. Forecasted escapement for the 2016 return year is about 44,000 spawning adults. The marine survival rate (Figure 3.49) has decreased below average for the two most recent brood years available for analysis. Tempered expectations of this stock aggregate's performance in coming years would be accordingly warranted.

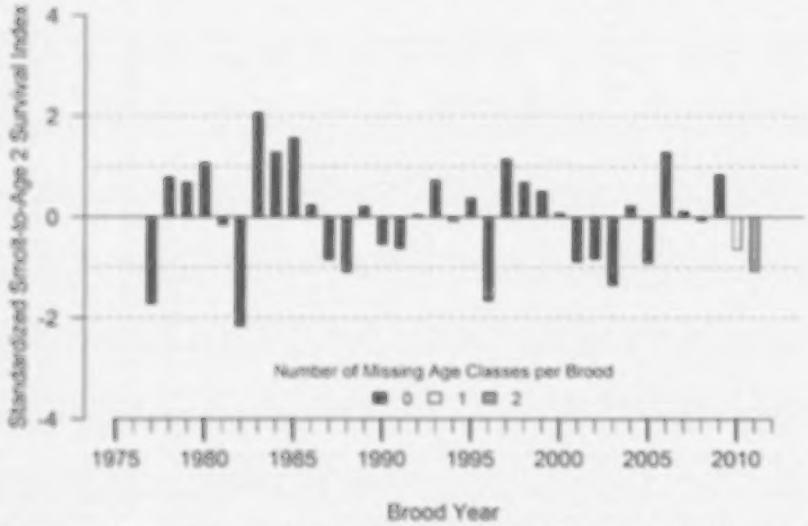


Figure 3.49.–Marine survival index (standardized to a mean of zero) for the Elk River hatchery stock of Chinook salmon.

REFERENCES CITED

ADF&G (Alaska Department of Fish and Game). 1981. Proposed management plan for Southeast Alaska Chinook salmon runs in 1981. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J81-03, Douglas, AK.

Ames, J., and D. E. Phinney. 1977. 1977 Puget Sound summer-fall Chinook methodology: escapement estimates and goals, run size forecasts, and inseason run size updates. Washington Department of Fisheries Technical Report 29, Olympia, WA.

Argue, A. W., J. Coursley, and G. D. Harris. 1977. Preliminary revision of Georgia Strait and Juan de Fuca Strait tidal salmon sport catch statistics, 1972–1976, based on Georgia Strait head recovery program data. Technical Report Series PAC/T-77-16.

Bailey, R. E., C. K. Parken, J. R. Irvine, B. Rosenberger, and M. K. Farwell. 2000. Evaluation of utility of aerial overflight based estimates versus mark-recapture estimates of chinook salmon escapement to the Nicola River, B.C. Canadian Stock Assessment Secretariat, Fisheries and Oceans Science, Research document 2000/152. http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2000/2000_152-eng.htm.

Bernard, D. R., and E. L. Jones III. 2010. Optimum escapement goals for Chinook salmon in the Transboundary Alsek River. Alaska Department of Fish and Game, Fishery Manuscript No. 10-02. Anchorage, AK.

Bernard, D. R., S. A. McPherson, K. A. Pahlke, and P. Etherton. 2000. Optimal production of Chinook salmon from the Stikine River. Alaska Department of Fish and Game, Fishery Manuscript No. 00-01, Anchorage, AK.

Burnham, K. P., D. R. Anderson, G. C. White, C. Brownie, and K. H. Pollock. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph 5.

Candy, J. R., J. R. Irvine, C. K. Parken, S. L. Lemke, R. E. Bailey, M. Wetklo, and K. Johnson. 2002. A discussion paper on possible new stock groupings (conservation units) for Fraser River chinook salmon. Canadian Science Advisory Secretariat, Department of Fisheries and Oceans Canada, Research document 2002/085. http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2002/RES2002_085e.pdf (Accessed July 2015).

CCMP (Comprehensive Chinook Management Plan). 2010. Comprehensive Chinook management plan for Puget Sound Chinook: harvest management component. Northwest Indian Fisheries Commission and Washington Department of Fish and Wildlife, Olympia, WA.

Cooney, T. D. 1984. A probing approach for determining spawning escapement goals for fall Chinook salmon on the Washington north coast. Pages 205–213 [*In*] J. M. Walton and D. B. Houston, editors. Proceedings of the Olympic Wild Fish Conference, Peninsula College, Port Angeles, WA.

CTC (Chinook Technical Committee). 1992. Review of Alaskan procedures to estimate add-on and predicted effects of June fisheries. Pacific Salmon Commission, Report TCCHINOOK (92)–1, Vancouver, BC.

CTC (Chinook Technical Committee). 1997. Incidental fishery mortality of Chinook salmon: Mortality rates applicable to Pacific Salmon Commission Fisheries Report TCCHINOOK (97)-1, Vancouver, BC.

CTC (Chinook Technical Committee). 1999. Maximum sustained yield or biologically based escapement goals for selected Chinook salmon stocks used by the Pacific Salmon Commission's Chinook Technical Committee for escapement assessment. Pacific Salmon Commission, Report TCCHINOOK (99)–3, Vancouver, BC.

CTC (Chinook Technical Committee). 2002b. Catch and escapement of Chinook salmon under Pacific Salmon Commission jurisdiction 2001. Pacific Salmon Commission, Report TCCHINOOK (02)–1. Vancouver, BC.

CTC (Chinook Technical Committee). 2004a. Catch and escapement of Chinook salmon under Pacific Salmon Commission jurisdiction 2003. Pacific Salmon Commission, Report TCCHINOOK (04)–2. Vancouver, BC.

CTC (Chinook Technical Committee) 2004b. Standardized fishery regimes for Southeast Alaska Chinook fisheries. Pacific Salmon Commission, Report TCCHINOOK (04)–3. Vancouver, BC.

CTC (Chinook Technical Committee). 2004c. Estimation and application of incidental fishing mortality in Chinook salmon management under the 1999 Agreement of the Pacific Salmon Treaty. Pacific Salmon Commission, Report TTCHINOOK (04)–1, Vancouver, BC.

CTC (Chinook Technical Committee). 2005. Catch and escapement of Chinook salmon under Pacific Salmon Commission jurisdiction, 2003. Pacific Salmon Commission, Report TCCHINOOK (05)–2, Vancouver, BC.

REFERENCES CITED (Continued)

CTC (Chinook Technical Committee). 2011. Development of the technical basis for a Chinook salmon total mortality management regime for the PSC AABM Fisheries. Pacific Salmon Commission, Report TCCHINOOK (11)–2. Vancouver, BC.

CTC (Chinook Technical Committee). 2013. Annual report of catch and escapement for 2012. Pacific Salmon Commission, Report TCCHINOOK (13)–1. Vancouver, BC.

CTC (Chinook Technical Committee). 2014. 2013 Exploitation rate analysis and model calibration, Volume Two: Appendix supplement. Pacific Salmon Commission, Report TCCHINOOK (14)–1, V.2. Vancouver, BC.

DFO (Department of Fisheries and Oceans Canada). 2009. Revisions to official DFO commercial Pacific salmon catch estimates for 1996–2004. Canadian Science Advisory Secretariat, Science Advisory Report 2009/031.

Gray, D., T. Thynes, D. Gordon, A. Piston, D. Harris, and S. Walker. 2015. 2015 Southeast Alaska purse seine fishery management plan. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J15-04, Douglas.

Gray, D., R. Bachman, T. Kowalske, S. Forbes, B. Meredith, and E. Coonradt. 2015. 2015 Southeast Alaska drift gillnet fishery management plan. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J15-03, Douglas.

Dennis, B., J. M. Ponciano, S. R. Lele, M. L. Taper, and D. F. Staples. 2006. Estimating density dependence, process noise, and observation error. Ecological Monographs 76:323–341.

English, K. K., R. E. Bailey, and D. Robichaud. 2007. Assessment of Chinook salmon returns to the Fraser River using run reconstruction techniques, 1984–02. Canadian Science Advisory Secretariat, Research Document 2007/020.

Ericksen, R. P., and S. A. McPherson. 2003. Biological escapement goal for Chilkat River Chinook salmon. Alaska Department of Fish and Game, Fishery Manuscript No. 03-01, Juneau, AK.

Farwell, M. K., R. E. Bailey, and B. Rosenberger. 1999. Enumeration of the 1995 Nicola River Chinook salmon escapement. Canadian Manuscript Report Fisheries and Aquatic Science. Department of Fisheries and Oceans Canada.

Fraser, F. J., P. J. Starr, and A. Y. Fedorenko. 1982. A review of the Chinook and coho salmon of the Fraser River. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1126.

Garcia, S. M., and J. I. De Leiva Moreno. 2005. Evolution of the state of fish stocks in the Northeast Atlantic within a precautionary framework, 1970–2003: a synoptic evaluation. ICES Journal of Marine Science 62:1603–1608.

Hendrich, C. F., J. L. Weller, S. A. McPherson, D. R. Bernard. 2008. Optimal production of Chinook salmon from the Unuk River. Alaska Department of Fish and Game, Fishery Manuscript No. 08–03, Anchorage, AK.

Humbert, J-Y, L. S. Mills, J. S. Horne, and B. Dennis. 2009. A better way to estimate population trends. Oikos 118:1940–1946.

Joint Columbia River Management Staff. 2013. 2012 Joint staff report: Stock status and fisheries for spring Chinook, summer Chinook, sockeye, steelhead, and other species and miscellaneous regulations. Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife.

McIsaac, D. O. 1990. Factors affecting the abundance of 1977–79 brood wild fall Chinook salmon (*Oncorhynchus tshawytscha*) in the Lewis River, Washington. University of Washington, Seattle, WA.

McNicol, R. E. 1999. An assessment of Kitsumkalum River Chinook salmon, a North Coast indicator stock. Canadian Science Advisory Secretariat Research Document 99/164.

McPherson, S. A., D. R. Bernard, and J. H. Clark. 2000. Optimal production of Chinook salmon from the Taku River. Alaska Department of Fish and Game, Fishery Manuscript No. 00-02. Anchorage, AK.

McPherson, S. A., E. L. Jones III, I. A. Boyce, and S. J. Fleischman. 2010. Optimal production of Chinook salmon from the Taku River through the 2001 year class. Alaska Department of Fish and Game, Fishery Manuscript No. 10-03, Anchorage, AK.

REFERENCES CITED (Continued)

McPherson, S. A., P. Etherton, and J. H. Clark. 1998. Biological escapement goal for Klukshu River Chinook salmon. Alaska Department of Fish and Game, Fishery Manuscript No. 98–2, Anchorage, AK.

McPherson, S. A., and J. Carlile. 1997. Spawner-recruit analysis of Behm Canal Chinook salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J97–06, Douglas, AK.

PSC (Pacific Salmon Commission). 1991. A report to the Pacific Salmon Commission on a workshop held at Vancouver, BC, January 10 and 11, 1991, to explore alternative Chinook management approaches. Pacific Salmon Commission, PSC file 72006, Vancouver, BC.

Pahlke, K. A. 1995. Coded wire tagging studies of Chinook salmon of the Unuk and Chickamin Rivers, Alaska, 1983–1993. Alaska Fishery Research Bulletin 2(2):93–113.

Pahlke, K. A. 2003. Escapements of Chinook salmon in Southeast Alaska and Transboundary Rivers in 2001. Alaska Department of Fish and Game, Fishery Data Series No. 03-11, Anchorage, AK.

Pahlke, K. A., and P. Etherton. 1999. Chinook salmon research on the Stikine River, 1997. Alaska Department of Fish and Game, Fishery Data Series No. 99-06, Anchorage, AK.

Parken, C. K., R. E. Bailey, and J. R. Irvine. 2003. Incorporating uncertainty into area-under-the-curve and peak count salmon escapement estimation. North American Journal of Fisheries Management 23:78–90.

Parken, C. K., R. E. McNicol, and J. R. Irvine. 2006. Habitat-based methods to estimate escapement goals for data limited Chinook salmon stocks in British Columbia, 2004. Department of Fisheries and Oceans Canada, Canadian Science Advisory Secretariat Research Document 2006/083.

PFMC (Pacific Fishery Management Council). 2003. Review of 2002 ocean salmon fisheries. Pacific Fishery Management Council, Portland, OR.

QDNR (Quinault Department of Natural Resources). 1982. Assessment of stock and recruitment relationships for north coastal Chinook stocks. Quinault Department of Natural Resources, Technical Services Section, Taholah, WA.

QDNR (Quinault Department of Natural Resources) and WDFW (Washington Department of Fish and Wildlife). 2014. Development of escapement goals for Grays Harbor fall Chinook using spawner-recruit models. Washington Department of Fish and Wildlife, Olympia, WA. http://wdfw.wa.gov/publications/01599/wdfw01599.pdf (Accessed June 18, 2014).

Skannes, P., G. Hagerman, and L. Shaul. 2013. Annual management report for the 2012 Southeast Alaska/Yakutat salmon troll fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 13-06, Anchorage, AK.

Smith, C. J., and P. Castle. 1994. Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) escapement estimates and methods–1991. Washington Department of Fish and Wildlife, Project Report Series No. 1, Olympia, WA.

Staples, D. F., M. L. Taper, and B. Dennis. 2004. Estimating population trend and process variation for PVA in the presence of sampling error. Ecology 85:923–929.

Tompkins, A., B. Riddell, D. A. Nagtegaal, and D. Chen. 2005. A biologically-based escapement goal for Cowichan River fall Chinook salmon (*Oncorhynchus tshawytscha*). Department of Fisheries and Oceans Canada, Canadian Science Advisory Secretariat.

Vélez-Espino, L. A., G. Mullins, J. Willis, A. Krimmer, and W. Levesque. 2010. Mark–recapture experiment for the 2009 Chinook salmon spawning escapement in the Atnarko River. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2930.

Vélez-Espino, L. A., J. Willis, C. K. Parken, and G. Brown. 2011. Cohort analyses and new developments for coded wire tag data of Atnarko River Chinook salmon. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2958.

REFERENCES CITED (Continued)

Vélez-Espino, L. A., I. Winther, B. Koroluk, and G. Mullins. 2014. Time series calibration (1990–2013) and escapement goal for Atnarko River Chinook salmon. Canadian Manuscript Report of Fisheries and Aquatic Sciences 3085.

Weller, J. L., D. J. Reed, and G. M. Freeman. 2007. Spawning abundance of Chinook salmon in the Chickamin River in 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-63, Anchorage, AK.

Zhou, S., and R. Williams. 1999. Stock and recruitment analysis and escapement goals for Nehalem River fall Chinook. Oregon Department of Fish and Wildlife Information Reports 99-4, Fish Division, Portland, OR.

Zhou, S., and R. Williams. 2000. Escapement goals for Siletz River and Siuslaw River fall Chinook based on stock and recruitment analysis. Oregon Department of Fish and Wildlife Information Reports 2000-04, Fish Division, Portland, OR.

APPENDICES

Appendix A. Landed Chemical Salmon Catches by Regime and Gear, 1975–2014

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[illegible] Page

[illegible] Outstanding Prince WSBA Fishscale salmon handled adult (AC), releases (RelC), and incidental mortality (IMM) ..... [illegible]

[illegible] Oregon / WSBA Fishscale salmon handled adult (AC), releases (RelC), and incidental mortality (IMM) ..... [illegible]

[illegible] Summary of handled salmon (AC) of PNC WSBA and WSBA Fisheries ..... [illegible]

[illegible] Estimated incidental mortality (IMM and IMM) to nominal PNC associated with Fishscale salmon catches in US and Canadian WSBA and WSBA Fisheries ..... [illegible]

[illegible] Estimated total mortality (AC and IMM) associated with Fishscale salmon catches in US and Canadian WSBA and WSBA Fisheries ..... [illegible]

Table 10 – Hoodfriend Hoods HMM Smooth pitch or varnish

	Hoodfriend Hoods						
Year	Draft	Bite	Depth	Grain	Underlay	Textured Hoodfriend	Tonal depth
1970	107,000	1,000	17,000	111,000	50	0	50
1971	111,000	10,000	17,000	106,000	50	0	50
1972	111,000	10,000	17,000	106,000	50	0	50
1973	110,000	1,000	17,000	110,000	50	0	50
1974	110,000	1,000	17,000	110,000	50	0	50
1975	107,000	10,000	16,000	106,000	50	0	50
1976	105,000	10,000	16,000	105,000	50	0	50
1977	106,000	1,000	16,000	105,000	50	0	50
1978	106,000	10,000	16,000	105,000	50	0	50
1979	108,000	10,000	16,000	107,000	50	0	50
1980	109,000	10,000	16,000	108,000	50	0	50
1981	110,000	10,000	16,000	109,000	50	0	50
1982	111,000	10,000	16,000	110,000	50	0	50
1983	112,000	10,000	16,000	111,000	50	0	50
1984	113,000	10,000	16,000	112,000	50	0	50
1985	114,000	10,000	16,000	113,000	50	0	50
1986	115,000	10,000	16,000	114,000	50	0	50
1987	116,000	10,000	16,000	115,000	50	0	50
1988	117,000	10,000	16,000	116,000	50	0	50
1989	118,000	10,000	16,000	117,000	50	0	50
1990	119,000	10,000	16,000	118,000	50	0	50
1991	120,000	10,000	16,000	119,000	50	0	50
1992	121,000	10,000	16,000	120,000	50	0	50
1993	122,000	10,000	16,000	121,000	50	0	50
1994	123,000	10,000	16,000	122,000	50	0	50
1995	124,000	10,000	16,000	123,000	50	0	50
1996	125,000	10,000	16,000	124,000	50	0	50
1997	126,000	10,000	16,000	125,000	50	0	50
1998	127,000	10,000	16,000	126,000	50	0	50
1999	128,000	10,000	16,000	127,000	50	0	50
2000	129,000	10,000	16,000	128,000	50	0	50
2001	130,000	10,000	16,000	129,000	50	0	50
2002	131,000	10,000	16,000	130,000	50	0	50
2003	132,000	10,000	16,000	131,000	50	0	50
2004	133,000	10,000	16,000	132,000	50	0	50
2005	134,000	10,000	16,000	133,000	50	0	50
2006	135,000	10,000	16,000	134,000	50	0	50
2007	136,000	10,000	16,000	135,000	50	0	50
2008	137,000	10,000	16,000	136,000	50	0	50
2009	138,000	10,000	16,000	137,000	50	0	50
2010	139,000	10,000	16,000	138,000	50	0	50
2011	140,000	10,000	16,000	139,000	50	0	50
2012	141,000	10,000	16,000	140,000	50	0	50
2013	142,000	10,000	16,000	141,000	50	0	50
2014	143,000	10,000	16,000	142,000	50	0	50
2015	144,000	10,000	16,000	143,000	50	0	50
2016	145,000	10,000	16,000	144,000	50	0	50
2017	146,000	10,000	16,000	145,000	50	0	50
2018	147,000	10,000	16,000	146,000	50	0	50
2019	148,000	10,000	16,000	147,000	50	0	50
2020	149,000	10,000	16,000	148,000	50	0	50
2021	150,000	10,000	16,000	149,000	50	0	50
2022	151,000	10,000	16,000	150,000	50	0	50
2023	152,000	10,000	16,000	151,000	50	0	50
2024	153,000	10,000	16,000	152,000	50	0	50
2025	154,000	10,000	16,000	153,000	50	0	50
2026	155,000	10,000	16,000	154,000	50	0	50
2027	156,000	10,000	16,000	155,000	50	0	50
2028	157,000	10,000	16,000	156,000	50	0	50
2029	158,000	10,000	16,000	157,000	50	0	50
2030	159,000	10,000	16,000	158,000	50	0	50

Note: Field 36 – Hoodfriend Hoods varnish and HMM Hoodfriend Hoods Cage Pitch are mutually exclusive; varnish values that cross thresholds do change underlay and depth, which is intended behavior consistent with Hoodfriend Hoods calibration practice in Volume II of the Cage Pitch series.

Source: Ulster Hoodfriend Hoods Bulletin, Vol. 14, No. 3, pp. 41–58.

* Underlay values are rounded to the nearest multiple of 50 millibites.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 6.31 – Estimated cost of incidental hazardous substances with chemical release (Vessels in service and non-service)

	Tank		Hold		Deck		Total
Year	US$	US$	US$	US$	US$	US$	US$
2000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2008	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2009	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2010	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2011	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2012	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2013	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2018	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2019	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2020	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2022	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2023	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2024	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2025	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2026	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2027	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2028	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2029	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2030	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2031	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2032	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2033	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2034	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2035	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2036	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2037	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2038	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2039	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2040	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2041	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2042	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2043	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2044	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2045	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2046	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2047	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2048	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2049	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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2052	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2053	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2054	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2055	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2056	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2057	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2058	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2059	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2060	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2061	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2062	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2063	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2064	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2065	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2066	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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2068	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2069	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2070	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2071	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2072	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2073	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2074	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2075	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2076	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2077	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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2079	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2080	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2081	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2082	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2083	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2084	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2085	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2086	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2087	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2088	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2089	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2090	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2091	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2092	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2093	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2094	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2095	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2096	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2097	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2098	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2099	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Table A4.–Canadian Transboundary Rivers (Taku, Stikine, Alsek) ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Transboundary Rivers											
	Fresh Nakiona			Troll			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1970	1,028		47	178		0	0			1,202		
1971	1,078		49	236			200			1,510		
1972	470		23	42			300			812		
1973	750		25	100			300			1,150		
1974	2,170		99	872			718			3,756		
1975	612		38	1,869			358			3,087		
1976	736		34	977			516			2,269		
1977	1,018		47	1,873			879			3,770		
1978	1,375		63	1,553			315			3,293		
1979	802		37	537			563			1,896		
1980	1,066		49	759			658			2,479		
1981	1,707		79	1,608			570			3,985		
1982	1,455		69	1,512			829			3,836		
1983	1,845		86	2,179			780			4,805		
1984	1,853		86	2,759			727			4,954		
1985	1,098		50	3,710			1,980			5,798		
1986	1,572		72	2,757			894			5,123		
1987	1,311		60	2,675			400			4,586		
1988	1,240		57	2,830			503			4,587		
1989	1,797		83	3,513			738			5,592		
1990	1,858		87	3,747			1,801			6,456		
1991	1,369		64	5,809			1,130			8,312		
1992	1,588		73	4,596			831			6,731		
1993	868		40	3,598			642			4,918		
1994	1,334		70	4,157			642			6,295		
1995	1,835		78	3,882			633			6,331		
1996	954		44	2,881			439			4,074		
1997	1,470		67	2,895			580			4,912		
1998	1,035		70	3,835			431			5,401		
1999	2,458		113	4,589			401			7,478		
2000	952	0	44	10,258	–	535	323	0	22	11,533		1,001
2001	562	0	44	17,074	–	705	243	0	17	18,181	–	847
2002	791	0	36	14,721	–	1,239	185	0	10	15,646	–	1,285
2003	533	0	42	13,831	–	458	327	0	23	12,078	–	523
2004	543	0	43	13,131	1,113	568	143	0	10	13,818	1,113	597
2005	1,098	0	54	5,433	1,258	1,150	247	0	17	10,748	1,258	1,217
2006	555	0	46	7,769	1,168	1,731	299	275	23	9,087	1,443	1,780
2007	768	0	35	5,129	613	1,113	276	367	88	10,137	1,980	1,236
2008	1,458	0	67	4,858	38	283	160	197	49	6,472	235	399
2009	1,252	0	58	5,830	15	295	181	168	44	7,263	183	397
2010	1,136	0	56	5,385	0	240	235	48	25	6,836	48	329

Table A5.–Northern British Columbia (NBC) AABM Chinook salmon catches.

Year	Northern British Columbia		
	Area 1-5 Troll[1,2]	Areas 1,2E, 2W Sport	Total
1975	228,121	0	228,121
1976	190,267	0	190,267
1977	130,899	106	131,005
1978	146,054	125	146,179
1979	147,576	0	147,576
1980	157,198	200	157,398
1981	153,065	184	153,249
1982	173,472	215	173,687
1983	162,837	90	162,927
1984	185,134	171	185,305
1985	165,845	600	166,445
1986	175,715	1,153	176,868
1987	177,457	2,644	180,101
1988	152,369	7,059	159,428
1989	207,679	20,652	228,331
1990	154,109	16,827	170,936
1991	194,018	15,047	209,065
1992	142,340	21,358	163,698
1993	161,686	25,297	186,983
1994	164,581	28,973	193,554
1995	56,857	22,531	79,388
1996	8	670	678
1997	83,261	27,738	110,999
1998	109,072	34,130	143,202
1999	54,097	30,227	84,324
2000	9,948	22,100	32,048
2001	12,934	30,400	43,334
2002	102,731	47,100	149,831
2003	140,497	54,300	194,797
2004	167,508	74,000	241,508
2005	174,806	68,800	243,606
2006	151,485	64,500	215,985
2007	83,235	61,000	144,235
2008	52,147	43,500	95,647
2009	75,470	34,000	109,470
2010	90,213	46,400	136,613
2011	74,660	48,000	122,660
2012	80,257	40,050	120,307
2013	69,264	46,650	115,914
2014	172,001	44,900	216,901
2015	106,703	52,200	158,903

Note: troll (Areas 1–5) and tidal sport (Areas 1, 2E, 2W) are the components of the Northern British Columbia aggregate abundance-based management fishery.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2] Troll catches from 1996 to 2004 have been updated with data from DFO (2009).

Table A6.–Estimates of incidental mortality associated with Northern British Columbia (NBC) AABM Chinook salmon catches.

Year	Area 1-5 Troll[1]		Areas 1, 2E, 2W Sport		Total
	LIM	SIM	LIM	SIM	IM
1985	2,819	12,405	97	0	15,321
1986	2,987	19,637	204	0	22,828
1987	4,307	40,626	535	0	45,468
1988	4,829	40,749	1,505	0	47,083
1989	3,740	35,135	4,068	0	42,943
1990	5,195	46,172	3,248	0	54,615
1991	4,385	43,848	2,734	0	50,967
1992	4,985	49,332	3,634	0	57,951
1993	4,444	36,696	4,353	0	45,493
1994	3,709	27,882	4,524	0	36,115
1995	3,721	26,123	2,935	0	32,779
1996[2]	0	0	2,562	0	2,562
1997[2]	1,415	0	6,021	0	7,436
1998[2]	1,854	0	6,102	0	7,956
1999	920	674	3,605	0	5,199
2000	169	147	4,707	0	5,023
2001	376	276	5,955	0	6,607
2002	2,778	1,083	8,417	0	12,278
2003	4,772	740	9,519	0	15,031
2004	9,336	1,225	21,237	0	31,798
2005	7,896	446	12,221	0	20,563
2006	3,300	3,958	7,503	0	14,761
2007	2,282	3,771	7,870	0	13,923
2008	1,321	1,748	3,266	0	6,335
2009	2,069	3,625	4,011	0	9,705
2010	2,798	3,164	6,777	0	12,739
2011	7,732	1,773	9,114	0	18,619
2012	2,152	4,427	4,977	0	11,556
2013	7,236	3,390	9,300	0	19,926
2014	4,273	5,516	7,487	0	17,276
2015	5,442	2,785	13,446	0	21,673

Note: Troll (Areas 1–5) and tidal sport (Areas 1, 2E, 2W) are the components of the Northern British Columbia aggregate abundance-based management fishery.

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2] Release data are not yet available for 1996 to 1998.

Table A7.–Northern British Columbia (NBC) ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Area 1–5 First Nations			Area 1–5 Net			Tyee Test Fishery			Area 3–5 Sport			Area 1–5 Freshwater Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	4,055		187	24,786		1,140	309		14	0		0	0		0	29,150		1,341
1976	2,791		128	15,849		729	256		12	0		0	0		0	18,896		869
1977	6,998		322	43,926		2,021	270		12	1,670		60	2,158		149	55,022		2,564
1978	5,363		247	27,731		1,276	193		9	1,668		60	6,610		456	41,565		2,048
1979	5,266		242	40,208		1,850	432		20	2,523		91	1,960		135	50,389		2,338
1980	10,121		466	26,612		1,224	283		13	3,867		139	4,515		312	45,398		2,154
1981	11,115		511	41,379		1,903	345		16	2,760		99	2,613		180	58,212		2,709
1982	13,255		610	44,844		2,063	243		11	3,760		135	2,726		188	64,828		3,007
1983	15,532		714	16,752		771	362		17	4,092		147	5,374		371	42,112		2,020
1984	11,408		525	31,072		1,429	587		27	2,300		83	3,426		236	48,793		2,300
1985	15,794		727	39,543		1,819	545		25	3,600		130	3,186		220	62,668		2,921
1986	24,448		1,125	23,902		1,099	752		35	3,950		142	4,410		304	57,462		2,705
1987	16,329		751	17,494		805	725		33	4,150		149	3,625		250	42,323		1,988
1988	21,727		999	30,620		1,409	740		34	4,300		155	3,745		258	61,132		2,855
1989	21,023		967	38,403		1,767	653		30	4,150		149	5,247		362	69,476		3,275
1990	27,105		1,247	28,220		1,298	651		30	4,300		155	4,090		282	64,366		3,012
1991	23,441		1,078	40,782		1,876	591		27	4,256		153	4,764		329	73,834		3,463
1992	27,012		1,243	35,057		1,613	554		25	6,250		225	6,182		427	75,055		3,533
1993	21,353		982	33,351		1,534	776		36	3,279		118	7,813		539	66,572		3,209
1994	15,949		734	21,691		998	521		24	3,171		114	3,093		213	44,425		2,083
1995	13,635		627	17,629		811	464		21	2,475		89	3,503		242	37,706		1,790

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Year	Area 1–5 First Nations			Area 1–5 Net			Tyee Test Fishery			Area 3–5 Sport			Area 1–5 Freshwater Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1996	13,345		614	26,935		1,239	2,178		100	3,382		122	1,250		86	47,090	0	2,161
1997	14,610		672	18,749		862	1,578		73	0		0	0			34,937	0	1,607
1998	20,622		949	5,790		266	1,338		62	4,750		171	0			32,500	0	1,448
1999	27,399		1,260	8,123		374	2,135		98	11,700		421	0			49,357	0	2,153
2000	23,476		1,080	19,464		895	3,004		138	8,600		310	0			54,544	0	2,423
2001	23,508		1,081	22,580			2,953		136	11,000		396	0			60,041	0	1,613
2002	14,125		650	13,554		623	1,413		65	8,000		288	0			37,092	0	1,626
2003	20,950		964	13,094		602	1,636		75	8,000		288	5,711		394	49,391	0	1,929
2004	20,548		945	15,198		699	995		46	8,000		288	0			44,741	0	1,978
2005	17,553	NA	807	5,416	5,502	4,368	1,136	NA	52	8,000	0	288	0			32,105	5,502	5,515
2006	17,262	NA	794	10,571	9,904	7,968	1,178	NA	54	8,000	0	288	0			37,011	9,904	9,104
2007	14,087	NA	648	9,520	10,273	8,011	1,302	NA	60	8,000	0	288	0			32,909	10,273	9,007
2008	14,963	NA	688	4,619	3,359	2,829	1,293	NA	59	11,970	1,643	460	0			32,845	5,002	4,036
2009	13,083	NA	602	4,348	2,003	1,642	1,189	NA	55	9,177	1,703	601	0			27,797	3,706	2,900
2010	13,693	NA	630	2,191	0	101	959	NA	44	7,570	563	362	2,689	NA	186	27,102	563	1,323
2011	10,863	NA	500	3,586	0	165	976	NA	45	14,677	2,246	885	2,540	NA	175	32,642	2,246	1,770
2012	8,189	NA	377	788	3,067	2,661	575	NA	26	7,017	0	253	421	NA	29	16,990	3,067	3,346
2013	8,557	NA	394	2,126	3,163	2,739	547		25	10,259	560	458	2,024	958	324	23,513	4,681	3,548
2014	11,936	NA	549	2,632	3,317	3,023	482	NA	22	11,973	4,692	1,117	2,302	178	193	29,325	8,187	4,964
2015	17,524	NA	806	2,434	2,300	2,090	750	9	43	12,760	NA	459	3,442	NA	237	36,910	2,309	3,635

Note: NA = Not available.

Table A8.–Central British Columbia ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM)

	Central British Columbia																	
	First Nations			Net[1]			Troll[1,2]			Tidal Sport			Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			40,985			135,470			NA			NA			176,455		
1976	NA			32,669			145,204			NA			NA			177,873		
1977	6,972			32,409			122,689			4,773			1,544			168,387		
1978	7,944			35,708			91,025			5,694			1,770			142,141		
1979	7,585			50,445			107,884			5,225			1,940			173,079		
1980	6,240			27,715			95,377			4,802			988			135,122		
1981	5,701			18,912			69,247			3,490			1,261			98,611		
1982	9,112			32,429			69,748			5,429			1,293			117,991		
1983	6,642			12,556			97,847			4,271			821			121,537		
1984	9,736			4,630			78,120			4,354			1,332			98,172		
1985	6,019			12,391			27,090			3,943			823			50,266		
1986	6,353			23,032			54,407			4,566			1,245			89,603		
1987	6,296			10,893			65,776			3,933			1,563			88,461		
1988	6,000			12,886			36,125			3,596			1,496			60,103		
1989	8,992			6,599			21,694			3,438			4,526			45,249		
1990	9,811			18,630			29,882			4,053			5,626			68,002		
1991	8,801			15,936			29,843			4,409			3,335			62,324		
1992	8,533			18,337			47,868			4,891			3,304			82,933		
1993	9,095			10,579			23,376			6,114			2,880			52,044		
1994	5,383			14,424			18,976			4,303			973			44,059		
1995	3,501			11,007			5,819			2,172			1,180			23,679		

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Year	Internal Strike Indexes																	
	Time Numbers			Year[1]			Year[2]			Time Spent			Preliminary Spent			Total		
	LC	Rank	IRR	LC	Rank	IRR	LC	Rank	IRR	LC	Rank	IRR	LC	Rank	IRR	LC	Rank	IRR
1996	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
1997	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
1998	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
1999	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
2000	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
2001	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
2002	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
2003	[illegible]			[illegible]			[illegible]			[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
2004	[illegible]			[illegible]			[illegible]			[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
2005	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2006	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2007	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2008	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2009	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2010	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2011	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2012	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2013	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2014	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2015	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Note: NA = Not available.

[1] Full and non-strikes from 1996 to 2004 have been updated with data from NYC DOHMH, which includes strike and audit not Rubina Chhoun advice.

[2] Since 1996, the used accounting year for most Ministries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same used accounting period was applied for years prior to 1996.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table A11 –West Coast Vancouver Island (WCVI) ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	West Coast Vancouver Island ISBM														
	First Nations[1]			Net[2]			Tidal Sport[3]			Freshwater Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			19,233			NA			NA			19,233	0	0
1976	NA			17,892			NA			NA			17,892	0	0
1977	NA			13,785			NA			NA			13,785	0	0
1978	NA			25,143			NA			NA			25,143	0	0
1979	NA			35,623			7,964			NA			43,587	0	0
1980	NA			34,732			8,539			NA			43,271	0	0
1981	NA			36,411			11,230			NA			47,641	0	0
1982	NA			41,172			17,100			NA			58,272	0	0
1983	NA			37,535			28,000			NA			65,535	0	0
1984	NA			43,792			44,162			NA			87,954	0	0
1985	NA			11,089			21,587			NA			32,676	0	0
1986	NA			3,276			13,158			NA			16,434	0	0
1987	NA			479			38,283			NA			38,761	0	0
1988	NA			15,438			35,820			NA			51,258	0	0
1989	NA			48,921			95,239			NA			95,560	0	0
1990	1,159		55	29,579			69,723			NA			188,102	0	55
1991	41,577		1,901	60,797			85,983			NA			64,769	0	1,901
1992	8,215		382	5,686			46,968	28,322	8,679	NA			99,376	28,322	9,061
1993	5,078		234	28,694			65,694	37,263	11,681	NA			56,410	37,263	11,915
1994	1,525		70	2,369			52,536	26,000	8,616	NA			28,001	26,000	8,686
1995	5,868		270	458			21,675	9,797	3,377	NA			2,324	9,797	3,647

–continued–

Table A11.–Page 2 of 2.

	West Coast Vancouver Island ISBM														
	First Nations[1]			Net[2]			Tidal Sport[3]			Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1996	–			58			2,266	1,096	367	NA			2,324	1,096	367
1997	5,726		263	208			47,355	24,667	8,004	NA			53,289	24,667	8,267
1998	7,172		330	345			55,697	28,552	9,325	NA			63,214	28,552	9,655
1999	3,591		165	112			47,163	11,319	5,428	NA			50,866	11,319	5,593
2000	–			126			5,443	13,954	3,055	NA			5,569	13,954	3,055
2001	–			11			6,354	10,684	2,490	6,198			12,563	10,684	2,490
2002	10,893		501	260			36,073	14,629	5,298	77			47,303	14,629	5,799
2003	10,000		460	9,251			51,186	25,341	8,397	NA			70,437	25,341	8,857
2004	16,696		726	12,348			61,218	29,852	9,956	26			89,381	29,852	10,682
2005	35,000		1,610	23,599	354	4,687	43,577	9,534	4,837	6,225		430	108,401	9,888	11,564
2006	28,628		1,239	20,308	228	2,584	44,025	9,638	4,888	NA		0	92,961	9,866	8,711
2007	20,098		925	26,881	88	4,031	39,368	12,060	5,032	NA		0	86,347	12,148	9,987
2008	12,159		559	8,257	2	2,677	24,855	8,914	3,426	NA		0	45,271	8,916	6,663
2009	9,026		415	9,765	0	2,201	31,921	16,641	5,398	NA		0	50,712	16,641	8,014
2010	7,485		344	1,747	372	372	24,687	12,721	4,146	NA		0	33,919	13,093	4,862
2011	22,794		1,049	21,843	355	1,337	52,131	15,539	6,581	NA		0	96,768	15,894	8,967
2012	9,700		446	10,214	521	917	25,890	13,047	4,291	NA		0	45,804	13,568	5,654
2013	1,101		51	8,854	259	597	22,272	18,275	5,046	NA		0	32,227	18,534	5,694
2014	4,395		205	19,090	53	928	28,679	19,183	5,662	NA			52,164	19,236	6,795
2015	9,743	0	495	10,131	362	751	34,668	16,968	5,650	NA			54,542	17,330	6,895

Note: NA = Not available.

[1] First Nations catch is mainly commercial catch, 1996 to 2004 has been updated.

[2] Net catches from 1996 to 2004 have been updated with data from DFO Catch Finalization Project (2009).

[3] Prior to 1992, catch was not reported as inside or outside. Therefore inside catch for those years represents total tidal sport catch.

Table A12.–Johnstone Strait ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Johnstone Strait														
	First Nations			Net[1]			Troll[1,2]			Tidal Sport[3]			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			30,295			18,065			NA			48,360	0	0
1976	NA			31,855			30,838			NA			62,693	0	0
1977	NA			49,511			26,868			NA			76,379	0	0
1978	NA			55,148			13,052			NA			68,200	0	0
1979	NA			31,291			13,052			NA			44,343	0	0
1980	NA			30,325			11,743			NA			42,068	0	0
1981	NA			28,620			13,035			NA			41,655	0	0
1982	NA			29,454			11,234			NA			40,688	0	0
1983	NA			28,364			14,653			NA			43,017	0	0
1984	NA			18,361			9,260			NA			27,621	0	0
1985	NA			38,073			3,567			NA			41,640	0	0
1986	NA			17,866			3,951			NA			21,817	0	0
1987	NA			13,863			1,780			NA			15,643	0	0
1988	NA			6,292			1,566			NA			7,858	0	0
1989	NA			29,486			1,825			NA			31,311	0	0
1990	NA			18,433			2,298			NA			20,731	0	0
1991	1,287			15,071			1,228			9,311			26,897	0	0
1992	29			9,571			2,721			15,470			27,791	0	0
1993	20			15,530			4,172			12,679			32,401	0	0
1994	0			8,991			2,231			5,433			16,655	0	0
1995	71			970			4			4,296			5,341	0	0
1996	107			472			0			3,057			3,636	0	0

–continued–

Table A12.–Page 2 of 2.

Year	Johnstone Strait														
	First Nations			Net[1]			Troll[1,2]			Tidal Sport[3]			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1997	179			1,018			1,246			4,047			6,490	0	0
1998	138			328			2,129			2,710			5,305	0	0
1999	469			472			273			8,985			10,199	0	0
2000	212			280			85			5,960			6,537	0	0
2001	370			332			453			4,150			5,305	0	0
2002	400			569			129			3,696			4,794	0	0
2003	130			306			719			9,851			11,006	0	0
2004	28			525			316			16,131			17,000	0	0
2005	NA	NA	0	291	1,925	1,596	2	0	0	16,076	9,522	2,937	16,369	11,447	4,533
2006	200	NA	9	244	5,304	4,073	0	612	135	10,532	4,526	1,596	10,976	10,442	5,813
2007	200	NA	9	2	331	304	0	293	68	9,882	5,814	1,798	10,084	6,438	2,179
2008	324	NA	15	48	447	325	0	0	0	4,436	3,985	1,071	4,808	4,432	1,411
2009	344	NA	16	597	14	426	0	0	0	11,501	15,984	3,862	12,442	15,998	4,304
2010	250	NA	12	98	2,908	2,278	2	428	101	10,016	9,092	2,437	10,366	12,428	4,827
2011	268	NA	12	46	2,312	1,710	0	36	7	11,934	5,169	1,816	12,248	7,517	3,546
2012	321	NA	15	37	468	346	0	44	9	7,874	7,899	2,060	8,232	8,411	2,429
2013	258	NA	12	35	241	181	0	0	0	8,260	6,710	1,858	8,553	6,951	2,051
2014	1,637	NA	75	311	3,634	2,840	0	0	0	9,339	6,906	1,970	11,287	10,540	4,885
2015	261	0	12	54	1,162	848	0	0	0	11,931	8,717	2,497	12,246	9,879	3,357

Note: Troll = Area 12; Net = Areas 11–13.

Note: Sport based on July and August creel census in Area 12 and northern half of Area 13.

[1] Troll and net catches from 1996 to 2004 have been updated with data from DFO (2009).

[2] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. The same catch accounting period was applied for years prior to 1998.

[3] Tidal sport creel catches include additional catch estimated using Argue et al. (1977).

Table A13 – Georgia Strait ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Georgia Strait														
	First Nations			Rec[1]			Troll[2,3]			Total Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975							174,061			398,000			572,061	0	0
1976							200,129			490,000			690,129	0	0
1977							248,082			371,000			620,082	0	0
1978							217,805			500,000			717,805	0	0
1979							255,057			350,000			605,057	0	0
1980							273,677			398,000			671,677	0	0
1981							239,366			197,139			436,505	0	0
1982							179,440			124,390			303,430	0	0
1983							105,111			198,411			303,566	0	0
1984							95,380			303,445			818,715	0	0
1985							51,888			214,838			266,726	0	0
1986							44,041			181,898			125,939	0	0
1987							38,080			113,081			151,165	0	0
1988							35,124			128,117			128,341	0	0
1989							38,449			111,846			151,298	0	0
1990							34,359			111,814			146,118	0	0
1991							32,812			125,523			147,335	0	0
1992							37,254			116,581			151,851	0	0
1993							33,261			127,178			160,869	0	0
1994							12,916			70,839			83,755	0	0
1995							138			62,173			62,311	0	0
1996				0			14			88,189			88,611	0	0

continued

Table 4.5.11 - (Page 2 of 2)

Year	Average Profit														
	Price Taker			Mid[1]			Low[2]			Total Space			Total		
	(x)	(%x)	(%)	(x)	(%x)	(%)	(x)	(%x)	(%)	(x)	(%x)	(%)	(x)	(%x)	(%)
2007				[illegible]			[illegible]			[illegible]			[illegible]		[illegible]
2008				[illegible]			[illegible]			[illegible]			[illegible]		[illegible]
2009				[illegible]			[illegible]			[illegible]			[illegible]		[illegible]
2010				[illegible]			[illegible]			[illegible]			[illegible]		[illegible]
2011				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
2012				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
2013				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
2014				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
2015				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2016				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2017				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2018	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2019	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2020	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2022	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2023	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2024	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2025	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2026	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: Total = Price Taker + Mid + Low; Price Taker = Mid + Low; Total = Mid + Low.

[1] Mid-cost per capacity, other costs have been updated with data from EPA IPM.

[2] Since 1998, the cost accounting and tax treatment for nuclear and fossil plants changed. Low-capacity plants, the cost accounting and tax treatment for nuclear and fossil plants are applied to nuclear and fossil plants.

Table 8.21 Power Plus 1000 Chassis without Variable-work 4.21 (always 4Hz) and Accelerated Durability (AD)

Time	Power Plus 1000 Chassis											
	Cold Ambient			23°C			Hot Ambient (40°C)			Total		
	A	2MHz	AD	A	2MHz	AD	A	2MHz	AD	A	2MHz	AD
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
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[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
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[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]			[illegible]		

Table B.1.6 –Page 2 of 2

Year	Grouper Gluon Minnow-chub											
	Drum Seabass[1]			Wolf[2]			Freshwater Sport[3,4]			Total		
	LC	Bull	Off	LC	Bull	Off	LC	Bull	Off	LC	Bull	Off
1997	13,450			451,877			5,152			515,501	0	0
1998	19,732			8,250			18,173			451,947	0	0
1999	17,300			4,180			8,119			531,511	0	0
2000	21,829			8,290			11,834			451,919	0	0
2001	18,629			13,338	28	28	25,132			513,850	28	28
2002	21,738			9,722	1,129	280	28,101			521,689	1,129	280
2003	28,137			11,218	287	172	18,141			518,361	287	172
2004	21,180			18,228	137	106	18,141			518,371	137	106
2005	18,811	0	873	3,180	57	101	22,180	13,312	2,721	521,838	13,413	3,516
2006	19,732	212	814	7,180	41	212	28,184	114	1,180	451,141	344	2,275
2007	23,738	758	1,212	4,732	44	184	12,141	8,214	1,180	513,816	9,457	3,180
2008	22,817	58	372	4,271	81	172	18,137	12,813	3,180	451,141	12,941	4,813
2009	27,180	114	1,212	7,180	184	214	17,481	15,841	3,813	522,821	16,198	5,141
2010	22,812	258	581	12,381	47	481	18,128	12,212	3,141	451,719	12,877	5,378
2011	23,118	58	1,218	17,381	118	381	21,341	9,112	3,128	771,458	9,212	5,181
2012	18,212	118	1,778	2,381	1	178	11,381	7,121	2,128	511,814	7,412	4,149
2013	17,812	112	881	3,128	8,387	8,112	11,148	11,212	2,758	511,722	16,821	9,757
2014	21,458	41	1,481	17,148	3,218	3,481	13,117	13,814	3,411	512,148	22,214	13,358
2015	19,218	72	1,212	7,212	1,328	2,148	18,187	8,712	2,387	511,251	11,758	6,348

[1] Drum Seabass: Chinook salmon catch includes hook, net, and commercial from the Haines and Juneau. Economic opportunity includes commercial fish.

[2] Wolf: Wolf catch includes commercial trawl (Wolf), net fisheries, Pink Salmon economic opportunities, and scientific licenses.

[3] Freshwater sport catch includes Fraser Hatchery and Hatchery Chinook salmon catch (adults only).

[4] Updated 1975 to 1980 sport catch from Fraser et al. (1982).

Table A15.–Canada: Strait of Juan de Fuca ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Canada: Strait of Juan de Fuca											
	First Nations			Net[1]			Tidal Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			9,799			NA			9,799	0	0
1976	NA			13,004			NA			13,004	0	0
1977	NA			25,344			NA			25,344	0	0
1978	NA			9,725			NA			9,725	0	0
1979	NA			8,665			NA			8,665	0	0
1980	NA			3,438			37,900			41,338	0	0
1981	NA			9,982			29,832			39,814	0	0
1982	NA			7,072			30,646			37,718	0	0
1983	NA			328			30,228			30,556	0	0
1984	NA			6,237			24,353			30,590	0	0
1985	NA			17,164			27,843			45,007	0	0
1986	NA			17,727			34,387			52,114	0	0
1987	NA			6,782			24,878			31,660	0	0
1988	NA			4,473			31,233			35,706	0	0
1989	NA			21,238			32,539			53,777	0	0
1990	42			7,405			30,127			37,574	0	0
1991	250			8,893			19,017			28,160	0	0
1992	302			10,023			21,090			31,415	0	0
1993	317			2,287			13,967			16,571	0	0
1994	600			8,931			14,372			23,903	0	0
1995	751			631			14,405			15,787	0	0
1996	20			655			19,012			19,687	0	0
1997	42			657			17,080			17,779	0	0
1998	1,500			495			9,709			11,704	0	0
1999	52			771			14,808			15,631	0	0

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Table A15.–Page 2 of 2.

Year	Canada: Strait of Juan de Fuca											
	First Nations			Net[1]			Tidal Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
2000	272			199			10,973			11,444	0	0
2001	135			439			23,463			24,037	0	0
2002	NA			345			24,084			24,429	0	0
2003	NA			292			26,630			26,922	0	0
2004	NA			187			40,877			41,064	0	0
2005	NA			153	0	110	30,480	11,857	4,380	30,633	11,857	4,490
2006	NA			155	801	606	26,437	5,079	2,799	26,592	5,880	3,405
2007	NA			138	690	534	26,549	11,832	4,104	26,687	12,522	4,638
2008	NA			172	573	442	22,263	6,540	2,792	22,435	7,113	3,234
2009	NA			385	0	277	25,587	44,169	10,246	25,972	44,169	10,523
2010	NA			206	1,239	920	15,612	4,868	2,012	15,818	6,107	2,932
2011	NA			278	1,522	1,166	21,075	12,878	3,927	21,353	14,400	5,093
2012	NA			284	1,124	853	22,154	10,603	3,564	22,438	11,727	4,417
2013	NA			273	1,411	1,099	32,363	24,550	6,947	32,636	25,961	8,046
2014	NA			137	495	475	20,290	15,771	4,428	20,427	16,266	4,903
2015	NA			17	2,610	1,885	41,292	25,941	7,830	41,309	28,551	9,715

Note: NA = Not available.

Note: Net = Area 20; Sport = Areas 19b and 20.

[1] Net catches from 1996 to 2004 have been updated with data from DFO (2009).

Table A16.–Washington: Strait of Juan de Fuca ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington: Strait of Juan de Fuca											
	Troll			Net			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	5,762	NA	144	8,048	NA	644	81,681	NA	11,844	95,491	NA	12,632
1976	10,486	NA	262	6,072	NA	486	75,308	NA	10,920	91,866	NA	11,668
1977	8,958	NA	224	16,794	NA	1,344	53,238	NA	7,720	78,990	NA	9,287
1978	10,002	NA	250	12,676	NA	1,014	62,299	NA	9,033	84,977	NA	10,297
1979	7,575	NA	189	13,479	NA	1,078	67,094	NA	9,729	88,148	NA	10,996
1980	10,688	NA	267	12,753	NA	1,020	56,415	NA	8,180	79,856	NA	9,468
1981	15,644	NA	391	21,607	NA	1,729	51,352	NA	7,446	88,603	NA	9,566
1982	18,952	NA	474	25,490	NA	2,039	29,842	NA	4,327	74,284	NA	6,840
1983	18,468	NA	462	16,761	NA	1,341	58,060	NA	8,419	93,289	NA	10,221
1984	15,805	NA	395	12,377	NA	990	48,003	NA	6,960	76,185	NA	8,346
1985	12,759	NA	319	12,965	NA	1,037	44,267	NA	6,419	69,991	NA	7,775
1986	30,346	NA	759	17,228	NA	1,378	69,000	NA	10,005	116,574	NA	12,142
1987	45,005	NA	1,125	11,439	NA	915	53,000	NA	7,685	109,444	NA	9,725
1988	49,755	NA	1,244	11,692	NA	935	39,000	NA	5,655	100,447	NA	7,834
1989	65,992	NA	1,650	10,306	NA	824	52,000	NA	7,540	128,298	NA	10,014
1990	46,940	NA	1,174	5,213	NA	417	50,903	NA	7,381	103,056	NA	8,971
1991	37,040	NA	926	3,750	NA	300	39,667	NA	5,752	80,457	NA	6,978
1992	31,370	NA	784	1011	NA	81	38,438	NA	5,574	70,819	NA	6,439
1993	10,422	NA	261	1,457	NA	117	32,434	NA	4,703	44,313	NA	5,080
1994	3,419	NA	85	5,895	NA	472	1,661	NA	241	10,975	NA	798
1995	6,406	NA	160	4,770	NA	382	6,349	NA	921	17,525	NA	1,462
1996	9,910	NA	248	604	NA	48	4,825	NA	700	15,339	NA	996

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Table A16.–Page 2 of 2

Year	Washington: Strait of Juan de Fuca											
	Troll			Net			Sport			Total		
	LC	Rel.	RR	LC	Rel.	RR	LC	Rel.	RR	LC	Rel.	RR
1997	847	NA	21	492	NA	39	12,238	NA	1,775	13,577	NA	1,835
1998	707	NA	18	266	NA	21	2,159	NA	313	3,132	NA	352
1999	658	NA	16	589	NA	47	1,990	NA	289	3,237	NA	352
2000	347	NA	9	800	NA	64	1,670	NA	242	2,817	NA	315
2001	1,974	NA	49	931	NA	74	4,819	NA	699	7,724	NA	823
2002	1,783	NA	45	1,074	NA	86	2,028	NA	294	4,885	NA	425
2003	436	NA	11	908	NA	73	5,290	28201	8325	6,634	28,201	8,408
2004	20,756	NA	519	593	NA	47	4,519	22275	6625	25,868	22,275	7,191
2005	5,350	NA	134	175	NA	14	2,700	10189	3122	8,225	10,189	3,250
2006	1,056	NA	26	994	NA	80	5,695	14823	4798	7,745	14,823	4,904
2007	4,346	NA	109	107	NA	9	6,967	23133	7210	11,420	23,133	7,327
2008	1,816	NA	45	4,579	NA	366	4,844	13359	4283	11,239	13,359	4,694
2009	3,359	NA	84	99	NA	8	11,167	46047	13960	14,625	46,047	14,052
2010	2,216	NA	55	2,220	NA	178	11,508	38036	11862	15,944	38,036	12,095
2011	3,818	NA	95	359	NA	29	9,504	20601	6899	13,681	20,601	7,023
2012	2,350	NA	59	1,544	NA	124	13,854	28,233	9,575	17,748	28,233	9,758
2013	3,295	NA	82	449	NA	36	14,900	59,364	18,070	18,644	59,364	18,188
2014	4,512	NA	113	1,314	NA	105	11,059	26,877	8,807	16,885	26,877	9,025
2015[1]	4,771	NA	119	828	NA	66	13,271	32,253	10,568	18,870	32,253	10,754

Note: Troll: Areas 5, 6, and 6C, Area 4B from January 1 – April 30 and October 1 – December 31; Net = Areas 4B, 5, 6, and 6C; Sport = Areas 5 and 6, 4B Neah Bay "add-on" fishery.
Note: NA = Not available; for fisheries without estimate of releases, RR is dropoff/dropout only.
[1] Current year not available; values are average of previous three years.

Table 61.7 - Washington: Sex-specific GDP (Chained without landed value) (G), volumes (Rel.), and multiplier numbers (m)

Year	Washington, Sex-specific											
	Tuff			Fish			Spirit			Total		
	G	Rel.	m	G	Rel.	m	G	Rel.	m	G	Rel.	m
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Table 10.7 (Page 1 of 2)

Date	Dashboard, 30-day											
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Table A2.8.—Washington: Other Puget Sound (SBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Washington: Other Puget Sound								
	Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	1,311,562	N/A	131,156	173,186	N/A	25,197	1,485,748	N/A	156,353
1976	1,831,283	N/A	183,307	251,248	N/A	21,323	2,082,527	N/A	204,630
1977	1,852,870	N/A	111,430	307,792	N/A	14,175	2,160,662	N/A	125,605
1978	1,516,258	N/A	112,104	118,573	N/A	14,562	1,634,831	N/A	126,666
1979	1,136,173	N/A	113,246	154,810	N/A	22,470	1,290,875	N/A	135,716
1980	1,771,516	N/A	113,721	142,759	N/A	20,798	1,914,275	N/A	134,477
1981	1,852,152	N/A	111,432	116,169	N/A	15,377	1,968,321	N/A	126,809
1982	1,852,278	N/A	111,542	85,793	N/A	12,427	1,938,077	N/A	124,969
1983	1,136,452	N/A	113,759	123,752	N/A	17,568	1,260,204	N/A	130,703
1984	1,181,248	N/A	118,428	111,781	N/A	14,207	1,292,989	N/A	132,517
1985	1,166,317	N/A	116,753	92,833	N/A	13,427	1,259,150	N/A	130,220
1986	1,153,333	N/A	115,283	88,333	N/A	12,750	1,241,333	N/A	128,033
1987	1,117,333	N/A	111,133	53,333	N/A	8,133	1,166,333	N/A	119,733
1988	1,131,333	N/A	113,183	43,333	N/A	6,125	1,174,333	N/A	119,775
1989	1,152,333	N/A	115,433	75,333	N/A	10,875	1,231,333	N/A	126,375
1990	1,751,533	N/A	176,267	73,333	N/A	10,725	1,824,533	N/A	186,992
1991	80,833	N/A	7,133	49,833	N/A	7,185	130,666	N/A	14,318
1992	43,833	N/A	5,177	53,833	N/A	7,833	97,666	N/A	12,967
1993	54,383	N/A	6,157	43,133	N/A	5,753	98,183	N/A	11,187
1994	43,177	N/A	5,186	68,181	N/A	6,836	111,358	N/A	12,832
1995	43,533	N/A	5,187	43,533	N/A	6,333	87,066	N/A	11,836
1996	43,833	N/A	6,333	128,133	N/A	8,833	171,966	N/A	15,421

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Table A18.–Page 2 of 2.

Year	Washington: Other Puget Sound								
	Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1997	47,522	NA	3,802	43,961	NA	6,374	91,483	NA	10,176
1998	50,915	NA	4,073	30,016	NA	4,352	80,931	NA	8,426
1999	91,947	NA	7,356	34,116	NA	4,947	126,063	NA	12,303
2000	79,494	NA	6,360	29,328	NA	4,253	108,822	NA	10,612
2001	123,266	NA	9,861	40,170	NA	5,825	163,436	NA	15,686
2002	108,566	NA	8,685	35,031	NA	5,079	143,597	NA	13,765
2003	86,206	NA	6,896	32,210	93,129	29,629	118,416	93,129	36,526
2004	69,211	NA	5,537	22,650	64,586	20,593	91,861	64,586	26,130
2005	82,629	557	7,156	30,760	50,748	18,061	108,638	51,306	25,217
2006	109,557	NA	8,765	40,082	152,129	46,582	149,639	152,129	55,347
2007	118,628	NA	9,490	57,468	149,778	48,473	176,096	149,778	57,964
2008	101,322	NA	8,106	36,969	86,174	28,455	138,291	86,174	36,561
2009	68,764	NA	5,501	33,332	75,820	25,153	102,096	75,820	30,654
2010	80,599	NA	6,448	32,817	43,512	16,420	113,416	43,512	22,868
2011	100,353	NA	8,028	29,829	78,760	25,433	130,182	78,760	33,461
2012	117,259	NA	9,381	45,279	113,847	37,076	162,538	113,847	46,457
2013	105,136	NA	8,411	36,276	62,066	21,894	141,412	62,066	30,304
2014	50,106	NA	4,008	23,911	45,496	15,660	74,017	45,496	19,668
2015[1]	55,959	NA	4,477	35,155	66,891	23,024	91,114	66,891	27,501

Note: Net = Areas 6B, 6D, 7B, 7C, and 7E, Areas 8–13 (including all subareas), and Areas 74C–83F; Sport = Areas 8–13 and all Puget Sound rivers.

Note: NA = Not available; for fisheries without estimate of releases, IM is dropoff/dropout only.

[1] Current year not available; values are average of previous three years.

Table A19.–Washington: Inside Coastal ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington: Inside Coastal								
	Net			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	34,859	NA	697	1,716	NA	118	36,575	NA	816
1976	51,995	NA	1,040	2,219	NA	153	54,214	NA	1,193
1977	72,467	NA	1,449	2,043	NA	141	74,510	NA	1,590
1978	32,662	NA	653	3,399	NA	235	36,061	NA	888
1979	36,501	NA	730	2,199	NA	152	38,700	NA	882
1980	47,681	NA	954	1,476	NA	102	49,157	NA	1,055
1981	36,880	NA	738	786	NA	54	37,666	NA	792
1982	33,271	NA	665	1,114	NA	77	34,385	NA	742
1983	16,210	NA	324	1,452	NA	100	17,662	NA	424
1984	16,239	NA	325	1,319	NA	91	17,558	NA	416
1985	25,162	NA	503	1,955	NA	135	27,117	NA	638
1986	29,000	NA	580	3,000	NA	207	32,000	NA	787
1987	51,000	NA	1,020	3,000	NA	207	54,000	NA	1,227
1988	74,000	NA	1,480	7,000	NA	483	81,000	NA	1,963
1989	85,000	NA	1,700	6,000	NA	414	91,000	NA	2,114
1990	57,770	NA	1,155	5,000	NA	345	62,770	NA	1,500
1991	54,397	NA	1,088	6,070	NA	419	60,467	NA	1,507
1992	64,223	NA	1,284	6,577	NA	454	70,800	NA	1,738
1993	59,285	NA	1,186	9,180	NA	633	68,465	NA	1,819
1994	46,059	NA	921	7,454	NA	514	53,513	NA	1,436
1995	46,490	NA	930	9,881	NA	682	56,371	NA	1,612
1996	55,408	NA	1,108	12,059	NA	832	67,467	NA	1,940
1997	28,269	NA	565	6,619	NA	457	34,888	NA	1,022
1998	20,266	NA	405	6,569	NA	453	26,835	NA	859
1999	11,400	NA	228	3,165	NA	218	14,565	NA	446
2000	15,660	NA	313	3,179	NA	219	18,839	NA	533
2001	19,480	NA	390	8,645	NA	597	28,125	NA	986
2002	23,372	NA	467	6,038	NA	417	29,410	NA	884
2003	18,443	NA	369	6,075	NA	419	24,518	NA	788
2004	21,965	NA	439	12,088	NA	834	34,053	NA	1,273
2005	20,668	NA	413	7,051	NA	487	27,719	NA	900
2006	27,414	NA	548	8,030	NA	554	35,444	NA	1,102
2007	12,353	NA	247	5,066	NA	350	17,419	NA	597

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Table A19.–Page 2 of 2.

Year	Washington: Inside Coastal								
	Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
2008	15,028	NA	301	3,808	NA	263	18,836	NA	563
2009	18,728	NA	375	6,629	NA	457	25,357	NA	832
2010	12,794	NA	256	6,831	NA	471	19,625	NA	727
2011	39,034	NA	781	13,340	NA	920	52,374	NA	1,701
2012	29,232	NA	585	9,646	NA	666	38,878	NA	1,250
2013	31,111	NA	622	10,188	NA	703	41,299	NA	1,325
2014	39,514	NA	790	9,740	NA	672	49,254	NA	1,462
2015[1]	32,494	NA	650	9,858	NA	680	42,352	NA	1,330

Note: Net = Areas 2A–2M and Areas 72B–73H; Sport = All coastal rivers, Area 2.1, and Area 2.2 (when Area 2 is closed)

Note: NA = Not available; for fisheries without estimate of releases, IM is dropoff/dropout only.

[1] Current year not available; values are average of previous three years.

Table A20.–Washington/Oregon North of Cape Falcon ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington/Oregon North of Cape Falcon											
	Troll			Net			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	268,971	NA	6,724	1,212	NA	24	265,785	NA	7,176	535,968	NA	13,925
1976	371,239	NA	9,281	203	NA	4	215,319	NA	5,814	586,761	NA	15,099
1977	244,491	NA	6,112	4	NA	0	197,563	NA	5,334	442,058	NA	11,447
1978	150,673	NA	3,767	4	NA	0	104,306	NA	2,816	254,983	NA	6,583
1979	133,035	NA	3,326	3	NA	0	84,977	NA	2,294	218,015	NA	5,620
1980	125,709	NA	3,143	1,215	NA	24	59,099	NA	1,596	186,023	NA	4,763
1981	109,519	NA	2,738	209	NA	4	96,151	NA	2,596	205,879	NA	5,338
1982	154,720	NA	3,868	267	NA	5	114,952	NA	3,104	269,939	NA	6,977
1983	63,584	NA	1,590	62	NA	1	51,789	NA	1,398	115,435	NA	2,989
1984	15,392	NA	385	0	NA	0	6,980	NA	188	22,372	NA	573
1985	55,408	NA	1,385	493	NA	10	30,189	NA	815	86,090	NA	2,210
1986	52,000	NA	1,300	0	NA	0	23,000	NA	621	75,000	NA	1,921
1987	81,000	NA	2,025	4,000	NA	80	44,000	NA	1,188	129,000	NA	3,293
1988	108,000	NA	2,700	3,000	NA	60	19,000	NA	513	130,000	NA	3,273
1989	74,600	NA	1,865	1,000	NA	20	20,900	NA	564	96,500	NA	2,449
1990	65,800	NA	1,645	0	0	0	32,900	NA	888	98,700	NA	2,533
1991	51,600	NA	1,290	0	0	0	13,300	NA	359	64,900	NA	1,649
1992	69,000	NA	1,725	0	0	0	18,900	NA	510	87,900	NA	2,235
1993	55,900	NA	1,398	0	0	0	13,600	NA	367	69,500	NA	1,765
1994	4,500	NA	113	0	0	0	0	NA	–	4,500	NA	113
1995	9,500	NA	238	0	0	0	600	NA	16	10,100	NA	254
1996	12,300	NA	308	0	0	0	200	NA	5	12,500	NA	313

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Table A20 – Page 2 of 2

Year	Washington/Oregon North of Cape Falcon											
	Troll			Net			Sport			Total		
	LC	Rel.	RR	LC	Rel.	RR	LC	Rel.	RR	LC	Rel.	RR
1997	20,500	NA	513	0	0	0	4,100	NA	111	24,600	NA	623
1998	20,615	12,496	3,577	0	0	0	2,292	2,729	471	22,907	15,225	4,048
1999	44,923	27,231	7,795	0	0	0	10,821	6,782	1,309	55,744	34,013	9,104
2000	20,152	12,215	3,497	0	0	0	9,242	8,433	1,515	29,394	20,649	5,011
2001	54,163	35,824	10,131	0	0	0	25,592	34,500	5,866	79,755	70,324	15,997
2002	106,462	60,250	17,423	0	0	0	60,575	74,008	12,737	167,037	134,257	30,159
2003	101,758	54,313	15,851	0	0	0	36,513	50,214	8,518	138,271	104,526	24,368
2004	88,225	83,219	22,594	0	0	0	27,090	74,410	11,893	115,315	157,629	34,487
2005	87,126	36,282	11,067	0	0	0	40,004	22,798	4,500	127,130	59,080	15,567
2006	57,313	52,482	14,291	0	0	0	11,176	10,309	1,848	68,489	62,791	16,139
2007	38,742	36,050	9,801	0	0	0	9,535	22,629	3,652	48,277	58,678	13,452
2008	35,100	NA	878	0	0	0	15,452	7,400	1,527	50,552	7,400	2,405
2009	25,410	NA	635	0	0	0	13,331	38,717	6,168	38,741	38,717	6,803
2010	88,565	NA	2,214	0	0	0	38,686	36,403	6,505	127,251	36,403	8,719
2011	61,433	NA	1,536	0	0	0	30,826	55,050	9,090	92,259	55,050	10,626
2012	99,792	NA	2,495	0	0	0	35,428	41,874	7,388	135,220	41,874	9,882
2013	91,915	NA	2,298	0	0	0	30,837	51,048	5,640	123,752	51,048	7,938
2014	116,489	NA	2,912	0	0	0	42,327	26,578	5,130	158,816	26,578	8,042
2015	125,384	NA	3,135	0	0	0	42,179	15,219	3,422	167,563	15,219	6,556

Note: Troll = Oregon Area 2, Washington Areas 1, 2, 3 and 4. Area 48 from May 1 through September 30 (during Pacific Fishery Management Council management). Net = Washington Areas 1, 2, 3, 4, 4A; Sport = Oregon Area 2, Washington Areas 1, 1.1, 1.2, 2, 3, 4 and 2.2 (when Area 2 is open).

Note: For fisheries without estimate of releases, RR is dropoff/dropout only.

Note: NA = Not available.

[1] Current year not available; values are average of previous three years.

Table 4(3): Columbia River 1000 (Thousand salmon landed catch (LC), release (Rel.), and incidental mortality (IM))

Year	Washington and Oregon Columbia River											
	Nonhooking Net			Treaty Indian Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
[illegible]	[illegible]	0	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 1.E.1 (Page 1 of 2)

Year	Electricity and Coal Prices, Industrial Sector[1]											
	Distillate Fuel			Coal[2] (dollars per million Btu)			Natural Gas			Coal		
	Nominal	Real	Index	Nominal	Real	Index	Nominal	Real	Index	Nominal	Real	Index
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1981	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1982	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1983	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1984	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1985	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1986	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1987	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1989	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1990	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1991	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1992	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1993	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1994	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1995	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1996	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1997	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1998	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1999	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2002	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2003	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2008	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2009	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2010	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

Table 6.2.2 – Oregon ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM)

Year	Oregon Coastal Inside								
	Troll			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1970	3,000	N/A	6	15,000	N/A	1,311	15,300	N/A	1,316
1971	1,000	N/A	17	21,000	N/A	1,465	22,000	N/A	1,464
1972	3,000	N/A	61	36,000	N/A	2,364	37,000	N/A	2,357
1973	1,000	N/A	17	37,000	N/A	2,623	38,000	N/A	2,673
1974	800	N/A	16	31,000	N/A	2,135	31,800	N/A	2,123
1975	300	N/A	6	22,000	N/A	1,618	22,300	N/A	1,625
1976	300	N/A	6	28,000	N/A	1,532	28,300	N/A	1,537
1977	600	N/A	8	23,000	N/A	1,687	23,600	N/A	1,664
1978	700	N/A	12	15,000	N/A	1,311	15,700	N/A	1,323
1979	1,000	N/A	17	27,000	N/A	1,843	28,000	N/A	1,860
1980	1,700	N/A	27	26,000	N/A	1,726	26,700	N/A	1,752
1981	1,500	N/A	30	33,000	N/A	2,277	34,500	N/A	2,307
1982	3,400	N/A	68	44,000	N/A	3,178	45,400	N/A	3,232
1983	4,800	N/A	77	45,000	N/A	3,381	53,800	N/A	3,458
1984	4,600	N/A	72	45,000	N/A	3,105	45,600	N/A	3,177
1985	0	N/A	0	38,000	N/A	2,422	38,000	N/A	2,422
1986	0	N/A	0	44,600	N/A	3,071	44,600	N/A	3,071
1987	300	N/A	4	35,000	N/A	2,451	35,300	N/A	2,457
1988	4,45	N/A	10	62,000	N/A	3,600	62,445	N/A	3,658
1989	371	N/A	4	33,650	N/A	2,310	33,561	N/A	2,326
1990	200	N/A	3	48,300	N/A	3,337	48,672	N/A	3,361
1991	505	N/A	14	64,212	N/A	3,878	67,151	N/A	3,856
1992	613	N/A	8	37,425	N/A	2,658	38,172	N/A	2,407
1993	820	N/A	14	37,550	N/A	2,421	38,840	N/A	2,425
1994	1,233	N/A	20	30,734	N/A	2,121	31,840	N/A	2,140
1995	1,840	N/A	30	33,242	N/A	2,255	35,122	N/A	2,325
1996	1,100	N/A	15	64,500	N/A	3,754	64,172	N/A	3,813
1997	1,433	N/A	24	41,025	N/A	4,215	42,710	N/A	4,241
1998	1,455	N/A	23	47,535	N/A	4,400	45,350	N/A	4,711
1999	1,720	N/A	34	71,724	N/A	4,345	73,504	N/A	4,505
2000	1,574	N/A	31	27,844	N/A	1,523	25,822	N/A	1,554

(continued)

Table A22 –Page 2 of 2.

Year	Oregon Coastal Inside								
	Troll			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
2006	1,884	NA	30	39,357	NA	2,716	41,241	NA	2,746
2007	1,018	NA	16	25,684	NA	1,772	26,702	NA	1,788
2008	208	NA	3	10,780	NA	744	10,988	NA	747
2009	293	NA	5	6,537	NA	451	6,830	NA	456
2010	1,315	NA	21	23,366	NA	1,612	24,681	NA	1,633
2011	1,954	NA	31	33,089	NA	2,283	35,043	NA	2,314
2012	636	NA	16	26,272	NA	1,813	26,908	NA	1,829
2013	1,088	NA	30	46,347	NA	3,191	47,435	NA	3,221
2014	847	NA	21	46,919	NA	3,237	47,766	NA	3,259
2015	1,556	NA	29	49,250	NA	3,398	50,806	NA	3,427

Note: Troll = late season off Ok River mouth, Sport = estuary and inland.

Note: NA = Not available.

[1] Preliminary value based on average harvest rates.

Table A23.–Summary of landed catches (LC) of PSC AABM and ISBM fisheries.

Year[1]	Southeast Alaska AABM[2,3]	Southeast Alaska Non-Treaty	US ISBM[4]	US Total	NBC AABM[2]	WCVI AABM[2]	Canada ISBM[4,5]	Canada Total	PSC Total
1975	317,707		1,114,493	1,432,200	228,121	546,214	949,027	1,723,362	3,155,562
1976	258,762		1,148,705	1,407,467	190,267	665,010	1,078,748	1,934,025	3,341,492
1977	302,178		972,299	1,274,477	131,005	545,742	1,070,562	1,747,309	3,021,786
1978	418,411		782,494	1,200,905	146,179	568,705	1,078,144	1,793,028	2,993,933
1979	382,641		729,715	1,112,356	147,576	477,222	991,275	1,616,073	2,728,429
1980	343,970		890,965	1,234,935	157,398	486,303	834,970	1,478,671	2,713,606
1981	289,034		780,208	1,069,242	153,249	423,266	753,274	1,329,789	2,399,031
1982	314,686		872,565	1,187,251	173,687	538,510	675,858	1,388,055	2,575,306
1983	311,658		637,407	949,065	162,927	395,636	643,778	1,202,341	2,151,406
1984	290,077		665,194	955,271	185,305	471,294	797,975	1,454,574	2,409,845
1985	268,293	6,246	734,112	1,002,405	166,445	345,937	560,860	1,073,242	2,075,647
1986	271,262	11,091	880,390	1,151,652	176,868	350,227	508,465	1,035,560	2,187,212
1987	265,323	17,095	1,171,719	1,437,042	180,101	378,931	403,645	962,677	2,399,719
1988	256,787	22,525	1,204,543	1,461,330	159,428	408,668	379,609	947,705	2,409,035
1989	269,522	21,510	1,002,266	1,271,788	228,331	203,751	487,390	919,472	2,191,260
1990	320,996	45,873	807,858	1,128,854	170,936	297,858	470,242	939,036	2,067,890
1991	297,986	61,476	599,264	897,250	209,065	203,035	559,065	971,165	1,868,415
1992	221,980	36,811	524,895	746,875	163,698	358,664	457,801	980,163	1,727,038
1993	271,193	32,910	488,236	759,429	186,983	300,345	460,543	947,871	1,707,300
1994	235,165	29,185	299,419	534,584	193,554	160,352	303,987	657,893	1,192,477
1995	176,939	58,800	351,046	527,985	79,388	95,410	205,325	380,123	908,108
1996	154,997	81,262	409,703	564,700	678	10,233	216,603	227,514	792,214

–continued–

Table A23.–Page 2 of 2.

Year[1]	Southeast Alaska AABM [2,3]	Southeast Alaska Non-Treaty	US ISBM[4]	US Total[6]	NBC AABM[2]	WCVI AABM[2]	Canada ISBM[4,5]	Canada Total	PSC Total[6]
1997	286,696	56,306	375,204	661,900	110,999	59,088	261,366	431,453	1,093,353
1998	243,152	27,441	268,688	511,840	143,202	9,317	195,646	348,165	860,005
1999	198,842	52,178	371,349	570,191	84,324	38,540	222,566	345,430	915,621
2000	186,493	76,797	342,086	528,579	32,048	88,617	168,545	289,210	817,789
2001	186,919	78,815	721,069	907,988	43,334	120,304	208,425	372,063	1,280,051
2002	357,133	69,401	822,691	1,179,824	149,831	157,886	238,976	546,693	1,726,517
2003	380,152	59,284	739,836	1,119,988	194,797	173,561	251,759	620,117	1,740,106
2004	417,019	82,249	733,195	1,150,213	241,508	215,252	295,628	752,388	1,902,601
2005	388,637	104,480	579,170	967,806	243,606	199,479	293,046	736,131	1,703,937
2006	360,066	75,439	538,765	898,831	215,985	145,485	265,787	627,257	1,526,088
2007	328,197	76,442	428,930	757,126	144,235	140,614	233,979	518,828	1,275,954
2008	172,841	71,389	519,001	691,842	95,647	145,726	184,055	425,428	1,117,269
2009	228,033	65,640	455,019	683,053	109,470	124,617	209,160	443,247	1,126,300
2010	230,750	53,949	775,549	1,006,300	136,613	139,047	166,004	441,664	1,447,964
2011	290,669	66,319	755,326	1,045,996	122,660	204,232	283,031	609,923	1,655,919
2012	242,549	52,473	771,545	1,014,094	120,307	134,468	191,724	446,499	1,460,593
2013	191,428	65,825	918,103	1,109,531	115,914	113,598	176,215	405,727	1,515,258
2014	435,166	57,336	993,653	1,428,819	216,901	188,374	234,514	639,789	2,068,608
2015	337,794	67,537	1,060,081	1,397,875	158,903	116,737	281,532	557,172	1,955,047

[1] All LC from 1975 to 1984 were taken prior to implementation of the PST.
[2] LC in AABM fisheries from 1985 to 1994 were taken under fixed ceiling management per the 1985 PST Agreement. Catches from 1995 to 1998 were between agreements. LC from 1999 to 2012 was taken commensurate with abundance-based management per the 1999 PST Agreement (1999–2008) and the 2009 PST Agreement (2009–present).
[3] Southeast Alaska nontreaty catches are primarily Alaska hatchery add-ons, but include terminal exclusions in some years from terminal catches from the Situk, Taku and Stikine rivers.
[4] US and Canadian ISBM fisheries had a pass-through obligation from 1985 to 1994 under the 1985 PST Agreement and have operated with ISBM index obligations since 1999, under the 1999 and 2009 Agreements
[5] Catches in the Canada ISBM column include catches in the Strait of Georgia (troll and sport), Central British Columbia troll, and Northern British Columbia net and mainland sport fisheries from 1985 to 1994 when these were AABM fisheries operating under fixed ceiling management provisions of the 1985 PST Agreement.
[6] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

Table A24.–Estimated incidental mortality (LIM and SIM in nominal fish) associated with Chinook salmon catches in US and Canadian AABM and ISBM fisheries.[1]

Year	Southeast Alaska AABM[2]	Southeast Alaska Non-Treaty	US ISBM	US Total[5]	NBC AABM[2]	WCVI AABM[2]	Can ISBM[3]	Can Total	PSC Total[4, 5]
2005	45,913	10,585	66,592	112,505	20,563	14,814	46,248	81,625	194,130
2006	47,975	8,625	92,958	140,932	14,761	11,557	33,914	60,232	201,165
2007	71,486	22,234	91,608	163,094	13,923	12,403	40,397	66,723	229,817
2008	38,134	8,633	60,848	98,982	6,335	12,312	23,848	42,495	141,477
2009	44,973	11,042	69,888	114,862	9,705	15,817	37,925	63,447	178,309
2010	38,428	5,517	74,273	112,701	12,739	16,017	24,680	53,436	166,137
2011	41,595	9,887	88,848	130,443	18,619	17,005	31,538	67,162	197,605
2012	45,885	19,637	93,321	139,206	11,556	16,390	32,375	60,321	199,527
2013	59,411	42,813	106,275	165,686	19,926	16,606	48,347	84,879	250,565
2014	50,944	18,530	89,068	140,012	17,276	17,088	49,233	83,597	223,609
2015	46,567	20,817	100,226	146,793	21,673	10,971	43,652	76,296	223,089

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] The IM estimates presented in this table are not equivalent to LC on a one-to-one fish basis because of the inclusion of SIMs, which are smaller, less mature fish.

[2] IM estimates (LIM + SIM) are available for AABM fisheries from 1985 to present (CTC 2011).

[3] IM estimates for the ISBM fisheries prior to 2005 were not available for many subcomponents of these fisheries at this printing, but will be included in next year's CTC catch and escapement report.

[4] The PST total needs to be viewed with caution per footnote 1.

[5] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

Table A25 –Estimated total mortality (LC and IM) associated with Chinook salmon catches in US and Canadian AABM and ISBM fisheries.

Year	Southeast Alaska AABM	Southeast Alaska Non-Treaty	US ISBM	US Total[1]	NBC AABM	WCVI AABM	Can ISBM	Can Total	PSC Total[1,2]
2005	434,550	115,065	645,762	1,080,312	264,169	214,293	335,294	813,756	1,898,068
2006	408,040	84,065	631,723	1,039,763	230,746	157,042	299,701	687,489	1,727,252
2007	399,683	98,676	535,537	935,220	158,158	153,017	274,176	585,351	1,520,571
2008	216,875	80,023	579,848	796,824	101,982	156,038	207,903	467,923	1,256,746
2009	273,007	76,683	524,908	797,914	119,175	140,434	247,085	506,694	1,304,608
2010	269,179	59,467	849,822	1,119,001	149,352	155,064	190,684	495,100	1,614,100
2011	332,264	76,306	844,175	1,176,439	141,279	221,237	314,569	677,085	1,853,523
2012	288,434	72,109	864,866	1,153,300	131,863	150,858	224,099	506,820	1,660,120
2013	250,838	108,617	1,024,178	1,275,216	135,840	130,204	224,562	490,606	1,765,822
2014	496,110	75,864	1,082,722	1,568,832	234,177	205,462	283,787	723,386	2,292,218
2015	384,361	89,954	1,160,308	1,544,669	180,576	127,708	325,184	633,468	2,178,136

[1] Total mortality estimates prior to 2005 will be included in next year's CTC catch and escapement report when estimates from the ISBM fisheries are available.

[2] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

Appendix B. Escapements and Terminal Runs of Pacific Salmon Commission Chinook Technical Committee Coded-Wire Salmon Escapement Indicator Stocks, 1975–2004

Figure (B) — Page

B1. Southern Alaska estimates of escapement and t/v of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B2. Transboundary River estimates of escapement and t/v of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B3. Northern British Columbia escapements and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B4. Southern British Columbia escapements of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B5. West Coast Vancouver Island to Juan de Fuca escapements of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B6. Fraser River escapements and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B7. Puget Sound escapements and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B8. Washington Coast escapements and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B9. Columbia upriver spring and upriver summer escapements and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B10. Columbia River fall Chinook escapements and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B11. Oregon Coastal escapements as estimated via multivariate hatchery model and terminal runs (t) - cost of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks ..... [illegible]

B12. Oregon Coastal escapements and terminal runs (t) - cost as calculated by CWT-calibrated hatchery of Pacific Salmon Commission Chinook Technical Committee coded-wire escapement indicator stocks. Estimates presented to facilitate comparison with terminal runs since full studies ..... [illegible]

Table 42 – Hourliness Model estimates of [illegible] and 1/k of [illegible] Software Commission (Firmwide) Technical Committee unit (Firmwide) software management indicators results

	Southeast Utility (Firmwide Results)							
	Peak Rate		Average 1/k		Peak Rate		Average 1/k	
Year	Est	SE	Est	SE	Est	SE	Est	SE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 4B1 - (Page 1 of 2)

[illegible]											
	[illegible]			[illegible]			[illegible]			[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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[illegible]

Table 4.8 – Crowdsourcing office contractors and programmers cost (€) of Kyoto Protocol clinical transmission software / Montreal Protocol freon-free refrigerant policy, as reported in cylinder / device / device

	Crowdsourcing office contractors											
	Quarter 1				Year 1				Million 1			
Country	Low		High		Low		High		Low		High	
Aruba	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Cyprus	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Lithuania	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Ukraine	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Kosovo	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Cyprus	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Cyprus	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Ukraine

Table 8.2 –Page 2 of 2

Year	Transboundary River Stocks					
	Alsek R.		Taku R.		Stikine R.	
	Est	CV	Est	CV	Est	CV
2013	5,066	0.25	19,002	0.38	16,725	0.22
2014	3,607	0.25	23,532	0.09	24,360	0.15
2015	5,657	0.25	28,850	0.14	21,363	0.16
Lower	3,500		15,000		14,000	
Upper	5,300		36,000		29,000	

Table B3.–Northern British Columbia escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

		Northern British Columbia											
	Area 1	Area 3[2] Nass R.			Area 4 Skeena R.			Area 8 Dean R.	Area 8[2] Atnarko R.			Area 9 Rivers	Area 10 Smith
Year	Yakoun R. Esc	Above GW[2]	Esc	t. run	Total Esc	GSI[3] esc	GSI[3] SD	index	Total Esc	CV	Wild[4]	Inlet	Inlet[5]
1975	1,500		14,895	17,874	20,319				3,600			3,280	960
1976	700		13,819	16,583	13,078				11,700			1,640	1,000
1977	800	13,688	14,288	18,410	29,018				10,800			2,225	1,050
1978	600	15,485	16,885	21,807	22,661			3,500	13,500			2,800	2,100
1979	400	11,253	12,783	16,229	18,488			4,000	4,050			2,150	500
1980	600	13,476	14,855	18,744	23,429			2,000	6,480			2,325	1,200
1981	750	12,625	13,925	17,606	24,523			3,500	4,050			3,175	1,020
1982	1,400	7,959	10,359	13,287	17,092				7,200			2,250	1,500
1983	600	13,252	16,301	20,516	23,562			500	7,740			3,320	1,050
1984	300	20,987	24,987	31,408	37,598	51,348	14,818	4,500	13,788			1,400	770
1985	1,500	17,782	19,694	24,768	53,599	30,875	5,648	4,000	24,804			3,371	230
1986	500	36,523	38,123	47,967	59,968	28,398	6,204	3,300	19,170			7,623	532
1987	2,000	19,540	20,986	26,568	59,120	150,874	27,774	1,144	12,983			5,239	1,050
1988	2,000	15,345	16,715	21,094	68,705	91,496	13,217	1,300	13,500			4,429	1,050
1989	2,800	28,133	29,175	36,594	57,202	72,422	10,457	2,300	19,800			3,265	225
1990	2,000	24,051	26,551	33,384	55,976	64,188	10,638	2,000	16,710	0.143	11,630	4,039	510
1991	1,900	6,907	8,259	13,136	52,753	41,940	7,364	2,400	13,906	0.132	8,952	6,635	500
1992	2,000	16,808	17,408	25,405	63,392	103,365	25,532	3,000	32,862	0.128	22,015	7,500	500
1993	1,000	28,014	28,508	36,678	66,977	119,780	22,066	700	35,430	0.126	20,961	10,000	500
1994	2,000	21,169	25,689	32,864	48,712	78,228	14,149	1,300	28,178	0.112	12,257	3,500	700
1995	1,500	7,864	8,776	16,187	34,390	62,272	16,627	1,100	23,420	0.179	8,150	3,196	400
1996	3,000	21,842	22,712	30,889	73,684	155,637	32,769	2,000	20,767	0.106	5,962	3,000	250
1997	2,500	18,702	20,584	27,658	42,539	57,368	12,437	1,400	11,251	0.088	4,013	4,980	100
1998	3,000	23,213	25,361	34,922	46,744	80,677	16,199	3,000	13,470	0.078	6,094	5,367	1,100
1999	3,300	11,584	13,118	22,310	43,775	53,418	8,204	1,800	16,549	0.141	[illegible],199	2,739	500
2000	3,600	18,912	20,565	31,159	51,804	95,563	13,496	1,200	17,352	0.064	9,964	6,700	500

–continued–

Table B3.–Page 2 of 2.

		Northern British Columbia											
	Area 1 Yakoun R.	Area 3[1] Nass R.			Area 4 Skeena R.			Area 8 Dean R.	Area 8[2] Atnarko R.			Area 9 Rivers Inlet	Area 10 Smith Inlet[5]
Year	Esc	Above GW[1]	Esc	t. run	Total Esc	GSI[3] esc	GSI[3] SD	index	Total Esc	CV	Wild[4]		
2001	3,500	29,687	31,915	44,595	81,504	145,120	18,738	3,795	***21,635***	***0.034***	***16,743***	5,062	300
2002	3,000	13,773	15,382	21,528	44,771	89,235	11,984	3,731	***11,511***	***0.084***	***8,550***	5,031	
2003	4,000	26,940	28,330	36,503	56,758	114,346	16,234	3,700	***12,619***	***0.055***	***10,136***	1,900	
2004	4,500	15,912	18,185	25,137	44,243	142,141	19,631	3,500	11,825	0.089	8,230	3,950	
2005	5,000	14,363	16,595	24,067	29,067	77,531	9,783	2,200	11,677	0.110	7,619	5,585	
2006	NA	24,725	27,743	37,098	33,094	84,199	15,599	3,700	19,288	0.156	9,565	3,930	
2007	NA	21,459	25,524	34,221	33,352	85,179	17,559	2,300	8,229	0.061	5,799	5,000	
2008	NA	17,862	20,198	26,202	32,963	71,446	13,043	1,100	7,288	0.073	5,517	5,792	
2009	NA	28,710	30,334	36,865	38,297	80,900	16,297	1,400	***10,926***	***0.047***	***6,331***	4,580	
2010	NA	19,341	20,821	26,052	43,331	101,486	19,344	1,600	***10,497***	***0.059***	***5,683***	4,225	
2011	NA	9,639	10,415	15,092	37,073	53,682	12,239	750	***8,645***	***0.071***	***6,061***	4,400	
2012	NA	8,309	9,815	15,086	34,024	33,473	5,746	NA	***7,425***	***0.060***	***2,542***	4,142	
2013	NA	8,011	9,306	13,525	26,699	39,179	4,903	NA	***22,690***	***0.047***	***9,860***	4,672	
2014	NA	11,623	13,108	19,789	28,496	44,200	6,876	NA	***19,180***	***0.046***	***11,935***	4,190	
2015	NA	16,433	19,465	28,557	41,658	53,770	6,700	2,470	***44,594***	***0.120***	***13,640***	5,328	

Note: NA = Not available.

[1] GW refers to Gitwinksihlkw, the location of the lower fish wheels on the Nass River used to capture Chinook salmon for the MR estimate.

[2] Estimates prior to 1990 are visual counts, 1990–2000 and 2004–2008 are based on time series calibration, 2001–2003 and 2009–2014 are maximum likelihood estimates based on MR estimates.

[3] Genetic Stock Identification.

[4] Large wild Atnarko Chinook salmon.

[5] The Docee River was dropped as an escapement indicator beginning in 2002 due to an inability to obtain reliable escapement estimates.

Table B4.–Southern British Columbia escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Lower Strait of Georgia		Upper Strait of Georgia[1,2]					
Year	Nanaimo	Cowichan	Nimpkish	Klinaklini	Kakweiken	Kingcome	Wakeman	Esc. index
1975	5,475		1,100	16,560	200	1,500	1,500	20,860
1976	4,340		3,500	14,569	650	1,500	2,000	22,219
1977	6,530		750	21,078	130	750	750	23,458
1978	6,495		1,300	13,848	350	1,000	1,000	17,498
1979	2,741	7,945	500	7,955	60	50	233	8,798
1980	2,982	5,837	300	4,883	500	32	35	5,750
1981	225	5,782	700	8,619	200	20	25	9,564
1982	1,152	5,034	700	12,887	196	450	750	14,983
1983	1,840	4,742	1,500	10,536	160	359	309	12,864
1984	3,178	5,278	3,000	5,776	88	197	169	9,230
1985	914	3,675	3,000	9,327	500	150	300	13,277
1986	958	2,147	700	22,697	344	774	100	24,616
1987	757	2,519	3,000	27,069	411	1,500	1,000	32,980
1988	1,079	6,878	1,500	6,800	103	200	500	9,103
1989	1,552	5,535	3,850	40,002	607	500	800	45,759
1990	1,397	5,626	1,200	11,650	177	300	300	13,626
1991	935	7,408	1,400	22,784	140	526	300	25,150
1992	1,127	10,250	3,400	13,643	50	316	152	17,561
1993	1,405	7,030	300	3,406	53	193	223	4,175
1994	1,072	6,407	300	3,427	30	108	79	3,944
1995	2,300	16,449	300	4,755	157	426	54	5,692
1996	1,870	14,595	399	3,857	50	124	108	4,538
1997	1,772	9,973	350	3,800	39	450	125	4,764
1998	1,800	5,858	450	9,980	6	450	250	11,136
1999	2,371	6,110	640	11,068	146	70	281	12,205
2000	1,446	6,638	350	17,202	30	228	31	17,841
2001	2,448	5,015	365	9,355	129	527	116	10,492
2002	1,747	4,115	570	12,529	33	301	73	13,506
2003	1,672	3,356	385	13,365	164	122	21	14,057
2004	550	2,721	969	6,310	96	744	32	8,150
2005	1,036	2,467	576	3,980	60	95	28	4,739
2006	2,135	1,775	500	14,228	216	316	145	15,405
2007	2,267	2,175	514	5,791	88	75	90	6,558
2008	2,671	2,015	532	4,915	75	35	35	5,592
2009	1,470	785	929	10,134	154	64	19	11,300
2010	2,201	2,419	543	7,119	108	55	26	7,851
2011	3,937	2,786	720	4,829	5	6	20	5,580
2012	1,063	2,668	2,630	18,174	276	4	20	21,103
2013	593	4,406	2,589	18,041	274	26	24	20,954
2014	1,689	4,185	2,520	17,899	272	18	17	20,725
2015	3,146	5,984	1,659	15,254	231	494	424	18,062
Goal		6,500						

[1] Upper Strait of Georgia Strait escapement updated with time series for 5-stream index.

[2] The escapement time series for the UGS stock includes estimates based on consistent methods within each river, and escapements to rivers missing escapement data for some years (i.e., no surveys) were estimated using the procedures described by English et al. (2007).

Table B5.–West Coast Vancouver Island 6-stream index escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	WCVI[1]						
	Marble	Burman	Tahsis	Artlish	Kaouk	Tahsish	Esc. index
1975	400	200	75	25	75	25	800
1976	400	400	200	25	25	25	1,075
1977	950	500	150	60	75	100	1,835
1978	1,500	1,000	100	50	50	50	2,750
1979	750	650	348	40	60	200	2,048
1980	5,000	345	373	100	100	200	6,118
1981	3,000	300	150	500	100	1,000	5,050
1982	5,000	70	125	100	100	1,000	6,395
1983	1,000	475	50	400	300	500	2,725
1984	600	700	12	650	400	1,500	3,862
1985	1,250	500	50	400	300	1,200	3,700
1986	1,100	400	60	100	100	1,000	2,760
1987	1,750	100	20	100	100	500	2,570
1988	3,275	500	125			400	4,300
1989	4,181	780	500	40	30	450	5,981
1990	1,973	1,100	300	50	10	200	3,633
1991	710	2,767	1,515	20	20	120	5,152
1992	800	2,198	1,463	10	80	600	5,151
1993	2,000	1,750	578	10	20	250	4,608
1994	650	2,330	380	100	150	250	3,860
1995	1,626	594	525	99	266	600	3,710
1996	3,971	724	771	53	219	288	6,026
1997	2,638	2,354	722	402	558	523	7,197
1998	5,297	3,205	587	300	824	1,430	11,643
1999	4,185	2,399	1,731	539	453	879	10,186
2000	2,572	212	1,220	75	105	391	4,575
2001	1,450	107	389	139	409	237	2,731
2002	2,485	440	758	41	251	308	4,283
2003	1,749	768	762	379	358	440	4,456
2004	3,658	2,636	905	454	301	495	8,449
2005	2,354	642	182	199	488	121	3,986
2006	3,071	516	141	228	536	76	4,568
2007	2,764	353	133	162	193	234	3,839
2008	2,683	515	281	200	264	380	4,323
2009	3,440	1,800	780	214	550	80	6,864
2010	3,560	3,028	380	110	185	355	7,618
2011	3,910	2,020	220	100	300	260	6,810
2012	2,364	1,003	163	141	223	138	4,032
2013	2,081	8,285	545	399	240	350	11,900
2014	1,185	3,002	653	91	192	653	5,776
2015	6,516	6,292	310	1,113	331	768	15,330

[1] The escapement methodology changed for the WCVI streams in 1995, and the earlier estimates have not been calibrated.

Table B6.–Fraser River escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Fraser River									
	Fraser Spring Age 1.2 Esc	Fraser Spring Age 1.3 Esc	Fraser Summer Age 0.3 Esc	Fraser Summer Age 1.3 Esc	Fraser Spring/ Summer t. run	Harrison			Lower Shuswap[1]	
						Esc	CV	t. run	Esc	CV
1975	7,179	7,774	26,875	16,895	119,081				31,531	0.342
1976	4,600	9,472	4,925	13,705	98,691				3,778	0.418
1977	3,675	12,101	19,600	17,250	132,553				38,124	0.345
1978	4,305	14,985	16,700	19,210	109,119				17,804	0.343
1979	2,770	14,880	18,275	30,220	101,252				17,056	0.344
1980	6,255	16,250	8,350	13,678	73,504				8,291	0.383
1981	2,975	12,132	13,120	13,576	62,668				8,879	0.365
1982	5,510	14,925	6,850	15,230	85,140				3,299	0.43
1983	2,641	23,935	7,423	16,933	72,526				5,396	0.346
1984	6,180	30,245	12,378	14,469	95,681	120,837		56,492	7,582	0.08
1985	9,477	43,312	17,012	19,740	121,941	174,778		73,457	10,539	0.075
1986	10,275	50,550	22,860	33,195	144,617	162,596		80,821	20,828	0.341
1987	5,049	48,997	22,404	28,148	128,699	79,038		79,442	17,056	0.344
1988	4,003	41,683	29,567	33,239	129,587	35,138		90,572	24,669	0.34
1989	6,126	31,734	24,200	16,473	106,843	74,685		87,770	18,933	0.342
1990	3,225	41,460	25,425	33,833	135,124	177,375		83,401	22,741	0.34
1991	3,495	27,246	26,250	28,158	116,553	90,638		82,484	17,056	0.344
1992	5,937	33,038	32,200	37,964	130,249	130,411		93,978	23,317	0.34
1993	7,870	32,736	13,300	21,456	110,237	118,998		55,484	9,762	0.361
1994	10,913	51,595	25,350	23,695	145,303	98,334		100,453	28,864	0.341
1995	8,476	43,554	20,550	26,669	134,478	28,838		79,292	17,056	0.344
1996	21,303	34,536	50,900	43,155	185,559	37,394		151,339	23,520	0.343
1997	8,882	34,806	47,298	41,040	202,795	70,534	0.091	155,879	22,933	0.34
1998	2,752	27,374	70,094	36,441	169,133	200,258		181,506	34,050	0.341
1999	8,051	19,731	53,115	25,282	140,939	104,415	0.102	148,603	36,105	0.349
2000	11,420	24,615	45,161	25,295	155,209	77,754		144,647	27,800	0.08
2001	10,542	29,422	74,182	29,267	177,008	108,502		201,112	35,744	0.076
2002	16,432	39,992	89,314	35,619	181,357	83,011	0.082	218,965	54,219	0.017
2003	19,032	47,856	69,494	44,730	186,730	246,964	0.083	179,825	39,317	0.344
2004	11,486	31,988	60,953	30,873	135,296	139,126		150,754	36,963	0.045
2005	3,647	21,487	88,313	19,360	132,807	88,581	0.069	197,241	17,891	0.031
2006	6,948	21,797	149,883	20,345	198,973	60,422	0.135	325,076	59,085	0.024
2007	1,305	11,657	85,726	10,385	109,073	76,483	0.068	181,013	15,926	0.027
2008	6,123	16,824	106,593	16,496	188,355	41,603	0.073	269,705	14,922	0.037
2009	814	26,285	86,428	20,490	174,392	70,142	0.064	227,399	25,822	0.038
2010	6,432	17,884	157,280	18,163	233,620	103,515	0.056	364,921	73,354	0.021
2011	2,233	12,074	127,958	15,084	157,349	123,478	0.052	268,714	18,895	0.029
2012	7,314	11,569	47,949	9,144	75,976	44,467	0.086	111,757	4,091	0.03
2013	3,127	17,670	130,583	12,017	163,397	42,953	0.070	280,230	28,797	0.043
2014	11,813	36,553	77,721	21,906	147,993	64,685	0.087	193,173	43,952	0.094
2015	5,800	23,505	173,212	30,469	232,986	103,516	0.260	371,985	40,642	0.021
Goal						75,100				
Goal						98,500				

[1] Escapement was estimated by MR methods from 1983 to 1985, 2000 to 2002, and 2004 to 2012. All other years are calibrated values that have been estimated using a relationship between MR and peak counts.

Table 97.–Puget Sound escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	[illegible]																		
	Skagit River Spring		Skagit River Summer/Fall		Stillaguamish River			Snohomish River			Green River			Nooksack Spring				Lake Washington Fall	
	Esc.	T. run	Esc.	T. run	NOR esc.	Esc.	T. run	NOR esc.	Esc.	T. run	NOR esc.	Esc.	T. run	N. Fork Esc.	N. Fork NOR	S. Fork Esc.	S. Fork NOR	Esc.	T. run
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]
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Table E1 - Wages (1 of 2)

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Table D0 – Page 2 of 2

Washington Coast																		
	Quillayute Summer		Quillayute Fall		Hoh Spr/Sum		Hoh Fall		Hoko Fall		Quoratte Spr/Sum		Quoratte Fall		Grays Harbor Spring		Grays Harbor Fall	
Year	Esc	S. mark	Esc	S. mark	Esc	S. mark	Esc	S. mark	Esc[1]	S. mark	Esc	S. mark	Esc	S. mark	Esc	S. mark	Esc	S. mark
2002	1,182	1,140	4,187	3,212	2,864	3,272	4,471	5,718	693	1,083	738	710	2,813	1,171	2,598	3,217	11,941	16,833
2003	1,114	1,368	7,380	3,463	1,128	1,446	1,445	2,981	882	1,150	180	198	4,811	4,411	1,984	2,103	15,871	22,864
2004	1,850	1,258	3,831	4,110	1,786	2,238	3,213	4,433	964	1,186	414	413	4,178	4,878	1,034	1,330	21,777	42,121
2005	874	1,103	2,488	3,103	1,182	1,380	4,188	3,123	283	284	298	384	4,483	4,715	2,130	2,483	15,697	23,587
2006	723	414	3,406	7,458	584	1,184	1,230	2,338	641	801	130	138	2,131	4,268	2,489	2,884	17,410	24,518
2007	1,122	1,108	3,884	4,117	414	1,123	1,338	2,417	414	584	251	218	768	1,198	415	917	13,117	18,413
2008	1,140	1,184	3,413	3,758	417	717	2,388	3,311	411	413	381	381	2,371	4,208	984	987	15,391	18,144
2009	1,108	414	3,138	3,478	418	511	2,184	2,746	118	381	418	418	2,384	4,518	1,113	1,113	9,236	14,458
2010	777	584	4,210	4,388	418	412	2,388	3,184	213	751	218	218	3,184	4,384	2,418	2,418	18,171	25,798
2011	1,140	418	3,384	4,788	417	418	1,218	2,184	1,278	1,184	317	317	3,713	4,449	2,384	2,573	22,878	35,879
2012	1,218	814	3,114	4,488	511	1,418	1,317	2,778	411	412	718	718	3,184	4,717	818	1,111	14,114	24,788
2013	917	1,148	4,117	2,384	718	917	1,284	3,287	414	1,418	513	513	2,413	4,384	2,418	2,418	12,148	18,313
2014	418	814	2,784	3,317	714	413	1,313	2,418	1,114	1,718	317	417	3,184	3,141	1,513	1,513	12,413	N/A
2015	814	1,184	3,184	4,418	1,173	1,184	1,314	2,418	2,284	2,717	513	513	3,313	N/A	1,284	N/A	22,284	N/A
Total			3,488		584		1,284				718		2,584				13,314	

Notes: NA = Not available

[1] Escapement excludes brood stock for supplementation program. Total run includes redd count based escapement, terminal catch, and adult brood stock collected for supplementation and fish ladder program.

Table B9.–Columbia upriver spring and upriver summer escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks.

	Columbia Upriver Springs[1]						Columbia Upriver Summers[2]	
	Upper Columbia R.		Snake R. Spr/Sum		Total			
Year	Esc	t.run	Esc	t.run	Esc	trun.	Esc	t.run
1975								
1976								
1977								
1978								
1979							18,797	22,142
1980	2,772	7,128	6,134	20,968	8,906	28,096	13,854	22,498
1981	3,253	6,044	11,318	24,753	14,571	30,797	8,639	18,746
1982	3,015	6,314	11,307	27,601	14,322	33,915	6,587	14,369
1983	4,286	7,292	9,845	20,936	14,131	28,228	6,334	13,145
1984	4,608	6,706	7,929	14,119	12,537	20,825	13,984	18,765
1985	8,941	10,290	10,682	14,865	19,623	25,155	14,505	18,522
1986	5,519	7,903	11,359	20,085	16,878	27,988	14,850	18,752
1987	6,352	8,777	10,140	15,870	16,492	24,647	13,415	22,715
1988	5,658	7,503	11,182	17,368	16,840	24,871	13,634	22,720
1989	4,130	7,455	6,499	14,707	10,629	22,162	17,484	22,201
1990	2,808	4,437	9,357	17,582	12,165	22,019	13,432	18,794
1991	1,533	2,437	5,756	13,106	7,289	15,543	10,191	14,323
1992	3,163	4,261	12,677	20,657	15,840	24,918	7,706	9,428
1993	3,102	4,050	12,531	17,911	15,633	21,961	12,927	14,021
1994	611	1,044	1,856	3,721	2,467	4,765	12,292	14,691
1995	108	224	1,167	3,395	1,275	3,619	10,623	12,455
1996	317	575	3,643	9,062	3,960	9,637	9,417	12,080
1997	746	1,222	5,055	9,620	5,801	10,842	10,063	17,709
1998	367	547	7,281	13,725	7,648	14,272	11,225	15,536
1999	284	401	2,853	5,525	3,137	5,926	18,588	21,867
2000	904	1,367	8,187	13,921	9,091	15,288	20,218	22,595
2001	4,807	6,252	44,572	63,195	49,379	69,447	48,844	52,960
2002	1,957	2,992	29,872	52,202	31,829	55,194	86,825	89,524
2003	1,581	2,198	32,080	50,645	33,661	52,843	81,543	83,058
2004	1,641	2,308	20,967	33,102	22,608	35,410	62,311	65,623
2005	2,080	2,807	9,832	15,146	11,912	17,953	54,033	60,272
2006	933	1,462	9,340	16,831	10,273	18,293	61,821	77,573
2007	398	458	6,903	10,351	7,301	10,809	28,222	37,035
2008	675	829	17,171	23,939	17,846	24,768	38,171	55,532
2009	1,089	1,086	14,313	20,242	15,402	21,328	44,295	53,881
2010	2,476	3,102	25,211	34,797	27,687	37,899	47,220	72,346
2011	2,167	2,639	23,844	30,519	26,011	33,158	44,432	80,574
2012	4,238	5,690	24,828	35,760	29,066	41,450	52,184	58,300
2013	2,553	3,449	13,916	22,307	16,469	25,756	68,380	67,603
2014	4,203	6,234	31,208	45,562	35,411	51,796	77,982	78,254
2015	4,872	7,306	21,910	29,967	26,782	37,273	88,691	126,777
Goal							12,143	

[1] For the purposes of *US v. Oregon* management and tribal treaty/nontreaty allocation, the Columbia Upriver spring stock includes all fish destined to pass Bonneville Dam during the spring management period, including those destined for major tributaries such as the Deschutes and John Day rivers. These estimates of river mouth return and escapement are for only the adult upper Columbia wild spring Chinook salmon and the adult Snake River wild spring/summer Chinook salmon components. Escapements are past Rock Island Dam and past Lower Granite Dam (plus Tucannon River escapement), respectively. These are reported annually by the *US v. Oregon* Technical Advisory Committee (Joint Columbia River Management Staff 2013, Tables 8 and 9).

Table B9.–Page 2 of 2.

[2] Based on a stock–recruitment analysis of model data which included both hatchery and wild fish, an interim goal of 12,143 adult Mid-Columbia summers at Rock Island Dam was developed. For consistency with the goal, the escapement time series reported here was changed to the total adult Rock Island Dam count. The terminal run is that reported for Upriver summer Chinook salmon in the Joint Staffs Reports as the Bonneville Dam Count plus catch in lower river fisheries. These were also changed to include both hatchery and wild returns, where previously only naturally spawning returns were reported.

Table B10.–Columbia River fall Chinook escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks.

	Coweeman				Columbia Upriver Fall Chinook				
	Total	CV	Lewis River[1]		Deschutes River[2]			Upriver Brights[3]	
Year	Esc	(Total)	Esc	t.run	MR Esc	Esc	t.run	Esc	t.run
1975	296		13,859	13,859	M-R			29,600	164,105
1976	528		3,371	3,371				27,700	109,338
1977	337		6,930	6,930		7,903	9,764	36,060	85,336
1978	243		5,363	5,363		5,393	7,364	25,798	77,936
1979	344		8,023	8,023		5,126	6,718	28,926	82,482
1980	180		16,394	16,856		4,106	6,057	27,708	70,743
1981	116		19,297	20,298		6,070	7,907	19,520	58,693
1982	146		8,370	10,126		5,513	7,529	28,313	71,471
1983	122		13,540	14,489		5,491	6,987	45,567	79,113
1984	683		7,132	8,128		2,779	3,749	52,266	127,651
1985	491		7,491	8,241		7,902	8,709	74,206	187,691
1986	396		11,983	13,504		7,467	8,620	93,051	272,949
1987	386		12,935	14,173		9,187	11,244	126,153	409,412
1988	1,890		12,059	13,636		9,548	11,939	98,220	327,976
1989	2,549		21,199	22,813		6,339	8,069	83,281	253,233
1990	812		17,506	18,784		2,864	3,834	49,020	149,759
1991	340		9,066	10,354		5,374	5,528	40,132	97,758
1992	1,247		6,307	7,129		3,668	3,705	41,434	77,311
1993	890		7,025	8,106		8,809	8,820	42,515	94,088
1994	1,695		9,939	10,541		9,556	9,625	66,645	123,214
1995	1,368		9,718	12,155		9,304	9,340	50,595	97,119
1996	2,305		13,971	13,971		10,233	10,311	53,049	132,882
1997	689		8,670	8,670		20,208	20,341	50,215	141,386
1998	491		5,929	5,929		15,908	16,415	42,113	125,886
1999	299		3,184	3,184		7,389	7,762	43,313	158,044
2000	290		9,820	9,820		4,985	5,392	60,988	150,352
2001	802		13,886	14,186	9,527	12,817	9,861	84,652	222,630
2002	877	0.05	16,380	18,230	11,133	11,907	12,125	116,858	265,144
2003	1,106	0.03	18,505	20,505	14,265	13,413	15,343	161,005	357,848
2004	1,503	0.12	15,342	17,133	10,197	10,197	11,421	148,212	356,437
2005	853	0.2	11,348	13,348	9,355	14,937	10,190	111,148	258,554
2006	566	0.1	10,522	11,999	14,196	14,223	14,981	76,252	215,407
2007	251	0.19	3,468	3,606	13,181	12,721	13,968	44,962	98,657
2008	424	0.11	5,200	5,200		6,908	7,614	72,713	189,681
2009	783	0.07	5,410	5,760		6,429	7,116	84,327	204,932
2010	639	0.12	8,701	8,701		9,275	10,066	165,726	314,842
2011	566	0.08	8,009	11,025		17,117	18,168	129,496	305,940
2012	463		8,143	8,450		17,624	18,785	130,414	276,483
2013	2,035		15,197	20,267		18,068	20,305	370,267	764,029
2014	890		20,808	22,915		17,993	19,432	299,391	664,807
2015	1,449		23,631	25,327		17,074	18,194	388,999	777,721
Goal			5,700			4,532		40,000	

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Table B10.–Page 2 of 2.

[1] This is the number of naturally spawning adult fish in the Lewis River. The terminal run given is the escapement plus the Lewis River sport catch of wild adults.

[2] The first column gives the estimate based on a MR project for the entire river, which was used to verify the Sherars Falls estimates. The second column is the estimate based on using the ratio of redds above and below Sherars Falls. The time series of data through 2009 were updated based on a comprehensive analysis by Warm Springs, ODFW and Columbia River Intertribal Fish Commission (CRITFC) staff (Sharma, R, J. Seals, J. Graham, E. Clemons, H. Yuen, M. McClure, K. Kostow, and S. Ellis. Unpublished. Deschutes River Chinook spawner escapement goal using US v. Oregon Technical Advisory Committee data).

[3] The Columbia River Fisheries Management Plan (1988) stated an interim escapement goal of 40,000 natural spawning Upriver Brights at McNary Dam, including 38,700 for Hanford Reach and 1,100 Snake River. In 1990, the escapement goal was increased to 45,000 for increased hatchery programs. In 1994, a management goal of 46,000 was established, and in 1995, the management goal was retained while the escapement goal was reduced to 43,500. In 2002, the Columbia River Fisheries Management Plan (1988) escapement goal of 40,000 was agreed to by the Chinook Technical Committee. Escapement numbers given are McNary adult dam count minus adult sport and broodstock above the dam. The terminal run is the Columbia River mouth terminal run of Upriver Brights minus the Deschutes River fall Chinook salmon terminal run.

Table B11.–Oregon Coastal escapements as estimated via traditional habitat expansion methods and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Oregon Coastal							
	Nehalem R.		Siletz R.		Siuslaw R.		Coquille R.	
Year	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run
1975	5,197	5,303	2,062	2,689	4,427	4,548	4,927	NA
1976	9,807	9,908	1,326	2,036	7,999	8,153	2,188	NA
1977	11,478	12,093	3,314	3,919	9,492	10,362	4,379	NA
1978	12,059	12,244	2,062	3,700	5,872	6,879	3,951	5,290
1979	12,205	12,469	7,217	8,907	8,040	8,799	4,030	4,715
1980	5,555	5,832	3,680	4,820	10,630	11,183	4,014	4,622
1981	10,752	10,939	4,435	6,751	8,724	9,342	4,313	4,996
1982	5,085	5,282	3,415	4,514	10,870	11,774	6,249	6,865
1983	4,431	4,525	2,136	3,152	4,186	4,885	3,193	3,807
1984	20,341	21,623	3,461	4,552	11,168	12,437	4,502	5,164
1985	18,670	19,473	6,628	7,685	14,822	15,805	3,157	3,853
1986	10,389	11,920	6,748	7,799	14,844	15,965	4,470	5,125
1987	13,560	15,725	4,577	6,023	17,603	19,411	5,640	6,997
1988	14,889	17,185	7,805	9,257	41,746	44,380	7,451	8,635
1989	10,389	12,000	4,401	5,980	28,279	31,690	6,462	7,820
1990	5,104	6,789	4,313	5,373	26,799	29,593	6,064	7,567
1991	5,557	7,685	5,633	6,926	26,100	29,825	9,074	11,470
1992	9,060	11,863	6,044	7,460	26,090	28,350	13,293	15,911
1993	5,345	9,317	4,342	6,506	10,446	14,012	6,993	10,419
1994	6,486	9,412	10,475	12,188	23,570	25,890	6,698	8,696
1995	5,194	8,845	5,164	8,045	26,715	31,194	7,885	10,374
1996	9,211	13,285	7,394	10,274	33,051	39,705	6,346	8,790
1997	10,026	13,069	3,726	6,165	22,305	27,516	6,743	8,338
1998	8,245	10,869	5,516	7,175	24,708	28,882	9,930	12,680
1999	8,063	10,632	4,166	6,232	23,963	27,271	8,513	10,950
2000	6,855	9,119	6,787	9,462	15,730	19,588	6,684	8,974
2001	11,662	15,998	10,563	14,704	38,717	43,836	8,233	12,007
2002	18,089	22,657	14,054	19,019	41,058	47,905	11,848	15,578
2003	10,906	15,095	11,149	15,693	58,998	66,246	16,482	21,572
2004	9,975	14,792	3,902	10,419	40,033	46,062	11,346	14,041
2005	8,114	9,535	6,631	8,931	17,618	19,301	5,029	5,767
2006	4,711	5,902	4,108	6,194	28,082	29,926	3,009	3,790
2007	4,304	5,759	528	1,536	6,764	9,665	2,098	3,557
2008	3,810	4,865	1,202	1,682	11,119	12,405	4,562	5,813
2009	5,390	5,390	2,905	3,343	14,094	15,881	12,308	13,530
2010	5,384	7,254	4,225	5,118	22,197	25,846	32,318	36,940
2011	7,665	9,780	3,638	5,861	30,713	36,546	16,745	21,151
2012	7,515	10,068	4,812	6,657	20,018	24,112	9,300	12,541
2013	18,194	22,073	7,364	10,836	23,411	32,213	5,836	9,431
2014	11,452	16,210	8,655	13,136	28,200	34,750	10,418	14,978
2015	12,678	NA	6,367	NA	35,087	NA	12,409	NA
Goal	6,989		2,944		12,925		pending	

Table B12.–Oregon Coastal escapements and terminal runs (t. run) as estimated by MR calibrated indexes of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. Estimates presented in boldface represent estimates generated from direct MR studies.

	Oregon Coastal						
	Nehalem R.		Siuslaw R.		Umpqua R. S. Fork	Coquille R.	
Year	Esc	t. run	Esc	t. run	Esc[1]	Esc	t. run
1975	4,954	5,080	2,567	2,567	NA	6,668	NA
1976	9,345	9,446	4,565	4,565	NA	2,766	NA
1977	10,937	11,552	4,531	4,531	NA	5,676	NA
1978	11,491	11,676	2,867	3,874	400	5,618	6,957
1979	11,794	12,058	3,554	4,313	NA	5,203	5,888
1980	5,368	5,645	5,483	6,036	697	5,952	6,560
1981	10,390	10,577	3,767	4,385	890	6,405	7,088
1982	4,914	5,111	5,094	5,998	1,011	8,885	9,501
1983	4,282	4,376	923	1,622	1,628	4,686	5,930
1984	19,657	20,939	3,384	4,653	2,594	6,229	6,891
1985	18,042	18,845	6,845	7,828	2,246	4,498	5,194
1986	10,039	11,570	6,513	7,634	1,573	5,642	6,297
1987	13,103	15,268	5,568	7,376	2,795	6,429	7,786
1988	14,388	16,684	14,935	17,569	3,778	8,389	9,573
1989	10,039	11,650	12,856	16,267	6,162	6,968	8,306
1990	4,932	6,617	13,662	16,456	3,761	7,738	9,241
1991	5,370	7,498	15,709	19,434	6,717	10,508	12,904
1992	8,755	11,558	13,221	15,481	8,149	16,636	19,254
1993	5,165	9,137	2,960	6,526	3,364	7,446	10,872
1994	6,268	9,194	9,477	11,797	7,128	6,866	8,864
1995	5,020	8,671	10,246	14,725	11,388	12,060	14,549
1996	8,901	12,975	15,788	22,442	10,019	7,618	10,082
1997	9,689	12,732	8,313	13,524	7,286	8,580	10,175
1998	7,967	10,591	5,456	9,630	1,104	11,877	14,627
1999	7,792	10,361	11,785	15,09[illegible]	1,804	10,653	13,080
2000	**10,678**	**13,943**	4,648	8,506	3,140	7,880	10,170
2001	**12,431**	**16,767**	**9,723**	**14,482**	6,510	**12,512**	**16,206**
2002	**19,956**	**24,524**	**22,506**	**29,353**	3,831	**13,675**	**17,405**
2003	**21,283**	**25,472**	**28,801**	**36,050**	8,918	**18,676**	**23,966**
2004	9,639	14,456	**29,119**	**35,148**	7,487	**11,660**	**14,353**
2005	6,801	8,222	**13,771**	**17,700**	3,084	5,438	6,176
2006	11,938	13,129	**13,380**	**17,449**	2,396	7,438	8,219
2007	5,193	6,648	3,920	6,821	2,457	2,098	4,037
2008	4,596	5,651	4,544	5,830	2,333	5,803	7,661
2009	**5,786**	**5,786**	5,237	7,024	3,014	15,653	16,875
2010	**7,097**	**8,967**	11,165	14,813	6,184	41,104	45,726
2011	**11,084**	**13,199**	11,909	17,742	7,550	21,291	25,647
2012	**12,952**	**15,505**	16,314	20,408	5,635	11,828	15,069
2013	**15,989**	19,864	17,452	26,254	10,704	7,423	11,018
2014	13,817	18,575	**16,395**	22,945	7,153	13,250	17,810
2015	13,321	NA	19,361	NA	17,021	15,782	NA
Goal	pending		pending		pending	pending	

Note: NA = Not available.

[1] Preliminary analysis has shown that terminal catch of South Fork Umpqua River fall Chinook salmon is negligible.